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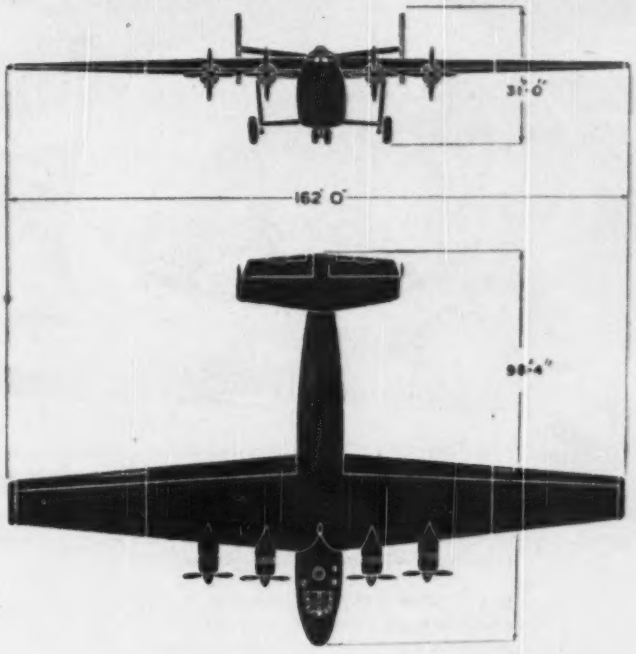

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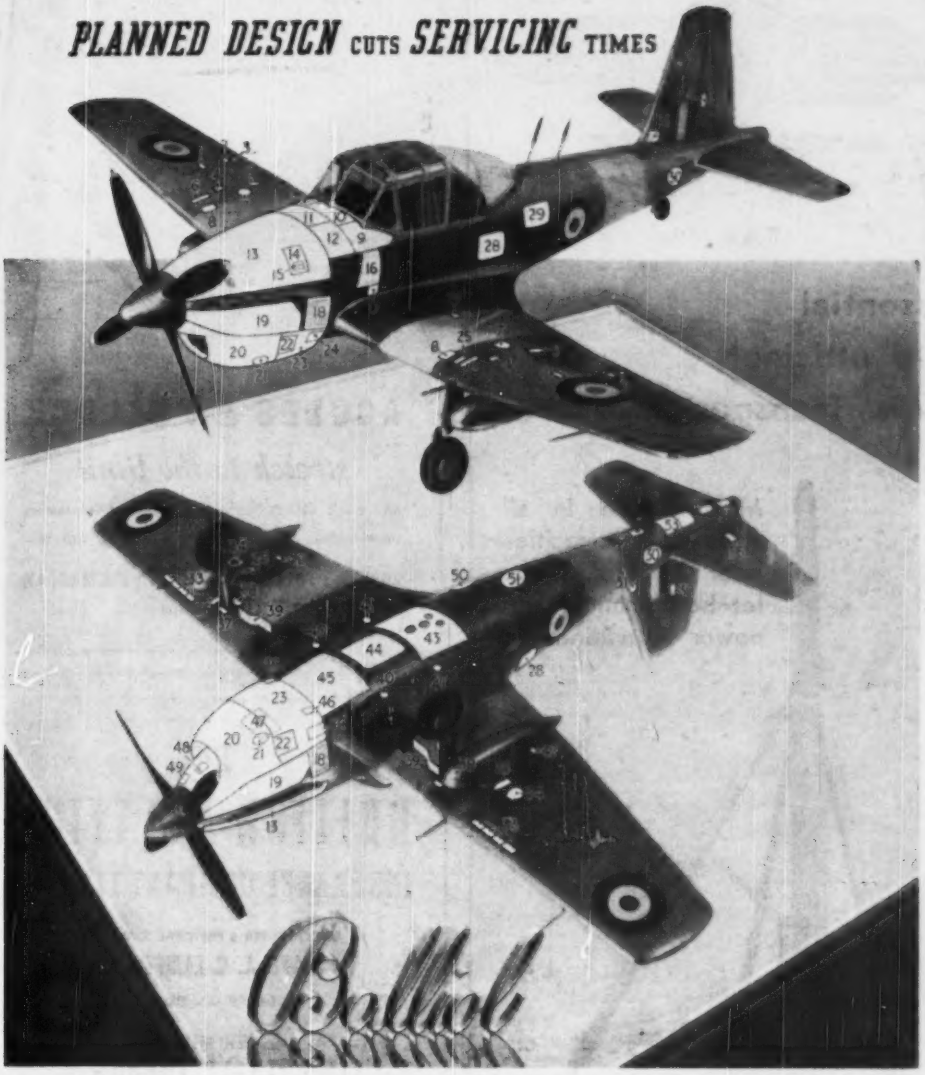

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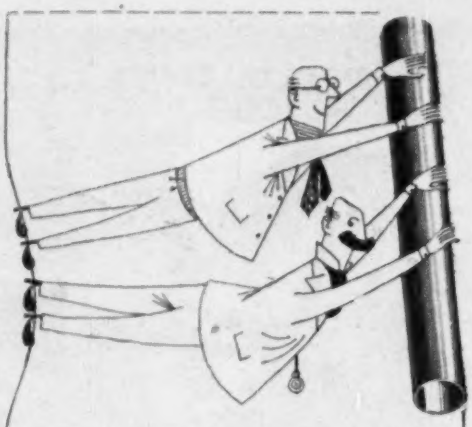

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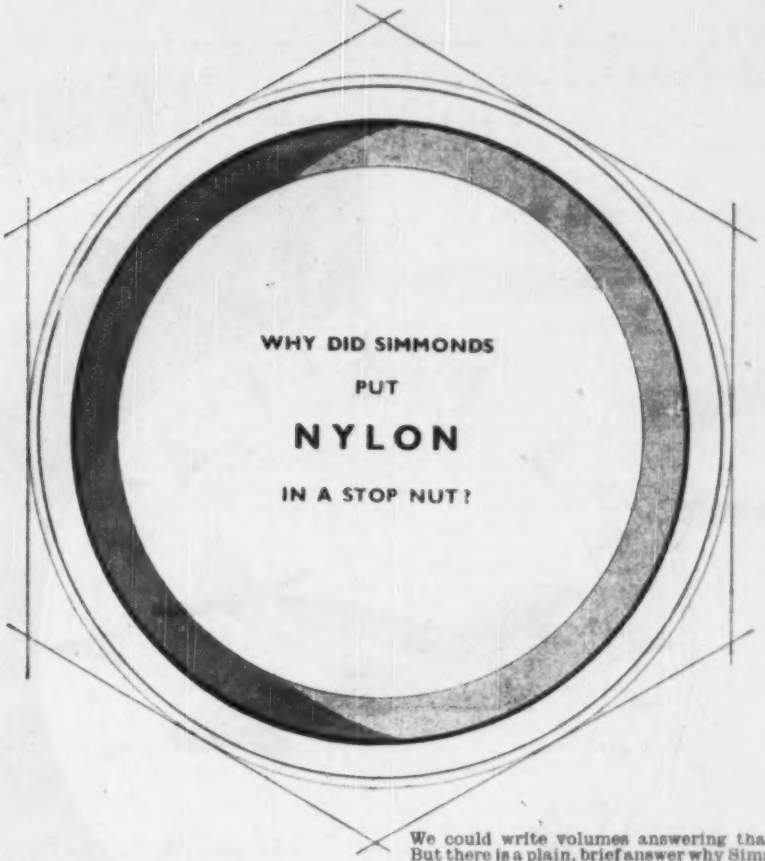

We could write volumes answering that one. But there is a plain, brief answer why Simmonds are now producing the NYLOC, the first Stop Nut with a Nylon insert. This is it: The NYLOC remains absolutely steadfast under extremes of temperature and humidity; under immersion in oil, petrol and boiling water.

NYLOC has immense endurance, for instance, a ¼" B.S.F. nut after 400 removals maintained a torque figure in excess of normal minimum requirements. Severe tests have resulted in the approval of the NYLOC Stop Nut for use in aircraft construction, and the following extracts have been taken from the Royal Aircraft Establishment test report:—

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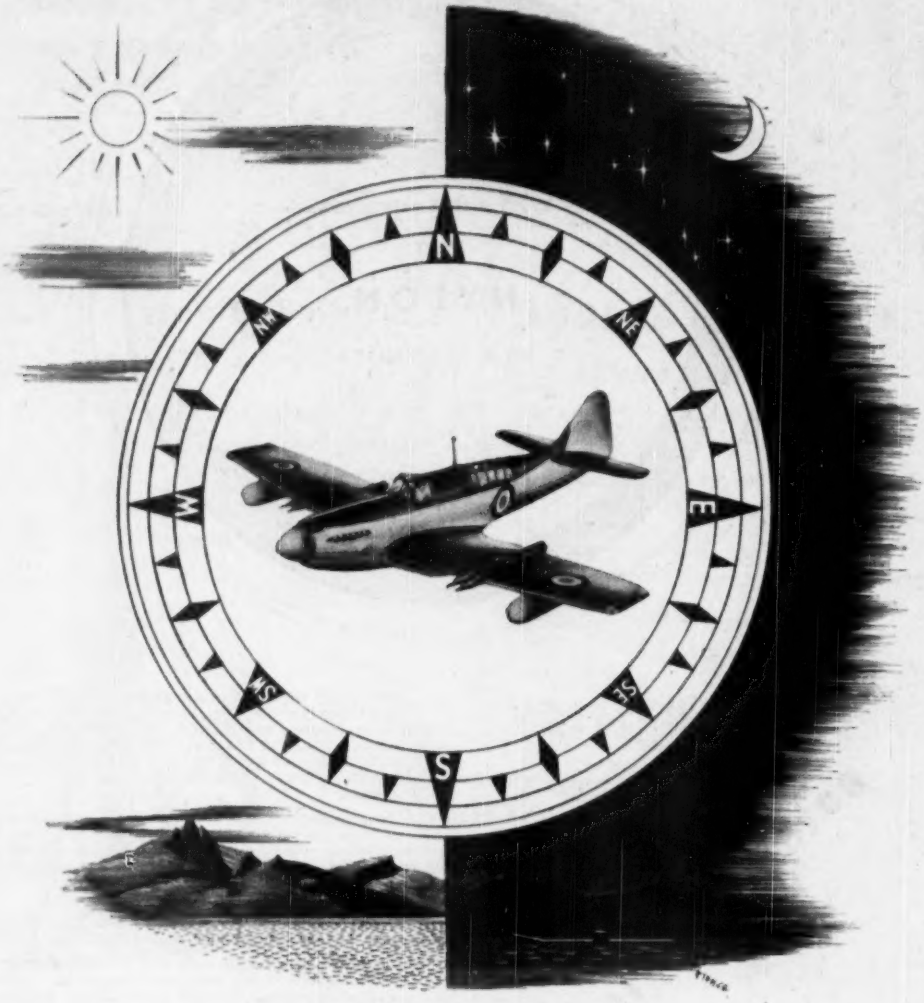

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Rocket Relativity

IN this issue are to be found details of the Sprite liquid-fuel rocket, developed by the de Havilland Engine Company. This little unit, the first physical outcome of the company's rocket research programme, can be regarded as a promising forerunner of future developments about which, however, nothing may as yet be said.

When it comes to the point there is, in fact, very little that can be said about British rocket work; the subject is swathed about with multiple veils of evasion and secrecy for which, certainly, there may well be every justification. Equally, however, the veils might well hide apathy and inconclusiveness.

Any intelligent person with some elementary knowledge of aviation is capable of reasoning for himself that it is logical to employ rocket units in jet aircraft—be they fighters or bombers—for the purpose of obtaining greatly increased thrust at high altitude in combat emergency. Not only is it a logical thing to do, but it has the backing of factual success achieved experimentally in America. We cite this as merely one application of the rocket in military aviation; there are many others.

In any event, virtually the whole of British rocket knowledge—other than of R.P.s using solid propellants—is based upon German research and experience, and whilst German rocket scientists are now working for us in this country, their colleagues are also working in America and in Russia. American achievements with rockets since the war have been somewhat spectacular and much publicized, but there is no reason to believe that they are any the less real on that account. Furthermore, such is the rate of development in the U.S.A. that it adds weight to informed opinion in this country that the science of rocket propulsion is as far advanced in America to-day as it was in Germany at the end of the war.

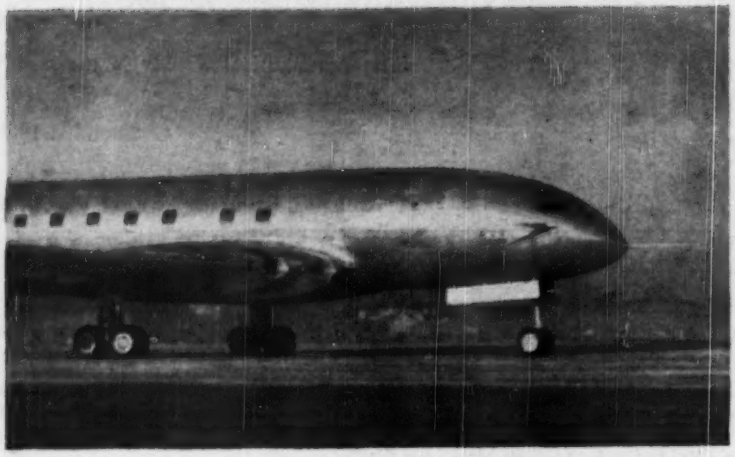
The British picture is very different. Certainly, it can be pleaded that we have neither the manpower nor the money; nor have we had, so far, the desert areas necessary for testing, although the Australian station at Woomera is being developed. Nevertheless, the fact remains that, although an enormous mass of data and equipment, and a large number of personnel fell into our hands with the surrender of Germany, the discouraging paucity of evidence available at the present time offers scant reassurance that our progress in this enormously important field is a matter for congratulation. The contrary, in fact, seems to be the case, for there is no published evidence to suggest that rocket progress in Great Britain to-day is as far advanced as was that of the Germans seven years ago.

Unified Screw-Threads

THE decision to replace the British standard screw-threads by a unified form, so that both the Americans and ourselves utilize a common standard, recently brought forth the publication of provisional specifications. Whilst stating that it is not intended to adopt the unified thread in the production of existing designs, the Ministry of Supply has also declared its intention to require that the new thread shall be employed wherever practicable, even though this may involve the use of both the new and previous standard thread forms in the same equipment during the transition period. There is thus every indication that aircraft and engines will eventually exist which will incorporate components, accessories, bolts, nuts, studs, unions, and so forth, both with the unified and present standard thread form, and that this condition might obtain for at least ten years.

Apart from the inevitable complication which must result throughout the whole of the enormous field catering for British Service needs, the position with regard to aircraft purchased by foreign powers is complicated by the fact that some countries operating British aircraft have decided not to adopt the unified thread. If, therefore, we are to continue to sell aircraft in these markets we shall, presumably, have to continue to supply the existing thread standards.

The whole subject is one of extreme importance, and the imperative need for issuing comprehensive, official guidance without delay cannot be overstressed.



The prototype Comet was recently fitted with a bogie undercarriage for a trial period, two four-wheel units replacing the earlier single main wheels. The third Comet, which is the first production machine intended for B.O.A.C., is also to be the first to have bogie landing gear as a standard fitment.

TWENTY-TWO WEEKS' PROGRESS

Comet Economics : Bogie Landing Gear : Air Conditioning Installed

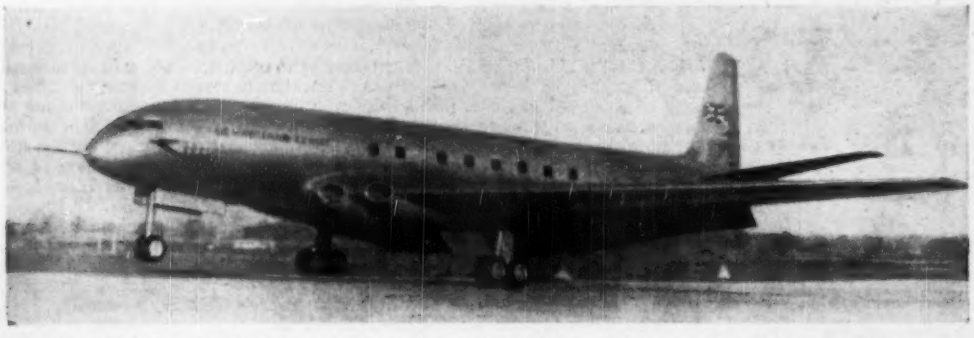
SINCE our last progress report on the D.H. Comet and its performance as measured during air tests (*Flight*, December 29th), the aircraft has completed initial taxying and landing tests with four-wheel bogie main landing-gear. The tests were regarded as very satisfactory. Far from looking clumsy, eight small (instead of two large) wheels enhance the appearance of the Comet, as the accompanying photographs indicate. At the end of the year the four-Ghost airliner had completed 121 flights totalling 153½ hours in only 156 days, and included in these totals are 56 landings with the bogie undercarriage.

During the past few weeks the prototype has been in the hangar for installation of its pressurization and air-conditioning system, and for the refitting of its single-wheel main landing-gear. No. 3 aircraft is the first to be designed to take the bogie gear and, therefore, also the first Comet to be without the slight bulges in the upper wing surfaces which were previously required to house the wheels. The prototype and production-style wheel wells are, in fact, quite different, and for this reason the bogie trials on the prototype had to be made with wheels locked down. It has been stated that the bogie-wheel housings will reduce fuel capacity. This is true—by 6½ gallons of kerosene on each side!

In addition to the smoother wing and the greater degree of safety in relation to the possibility of tyre-bursts, the bogie gear offers an advantage in braking, and also a small saving in weight. Tests were made at various aircraft landing-weights up to 80,000 lb and trials of fast taxying have been conducted with one tyre flat. Flights were also made with various c.g. positions, and a ciné-camera record was made as a check on landings and landing runs. Brake temperatures remained well below the limits.

Since the war ended the firm has organized factory space and facilities for an extensive programme of Comet production additional to the manufacture of other aircraft types; but the allocation and organization of manufacture are a major task and, it is stated, delivery of Comets to operators' requirements must depend upon a prompt indication of their needs.

Sufficient performance data has now been obtained from the 150 hours of test flying for the de Havilland Company to be able to announce some concrete and encouraging results of their studies of operating econo-



One of the 56 landings at various c.g. positions and all-up weights which were made during trials with the bogie landing gear. Satisfactory results are reported, including an improvement in braking. The bogies weigh less than the single main wheels.

mics. These are factual and refer to the prototype in its original form. Here it may be remarked that all aircraft engineers with experience of power-plant and installation problems realize the importance of establishing a reliable relationship between the fuel consumption and power figures registered on the test bed and those actually obtained in the air. The accuracy of the test-bed figures for thrust and consumption of the Ghosts in the Comet has been borne out by observations in the air.

A long statement by the makers on the economic aspect of Comet performance points out that, compared with the most modern airliners of its class at present in world service, the aircraft may be expected in operation to be about 20 per cent cheaper per ton-mile of payload, and to accomplish at least half as many more ton-miles in a year.

The 20 per cent figure is based upon a typical stage-length of 1,500 to 2,000 statute miles and a utilization of 3,000 hours a year. The method employed for costing is that established by the S.B.A.C., but the cost of kerosene has been reckoned at 2s 3d per Imperial gallon, and that for piston-engine fuel at 2s 10d (26 cents per U.S. gallon as against 33 cents). The first cost of the Comet is taken as £450,000. As the S.B.A.C. formula does not as yet provide figures for the cost of maintenance of gas turbines the de Havilland Company has made an assessment from all its knowledge and experience which yields a cost per hour slightly less than that of piston engines in comparable aircraft. The cost of airscrew maintenance is, of course, eliminated.

The company has made its allowances for stand-off, final circuits, etc., on a time-margin basis comparable with those for piston-engined airliners, and the allowance for diversion is, of course, on a distance basis for both types.

Travelling a greater distance in the hour with a given payload has the effect of making the cost per ton-mile less. It also enables the aircraft to accomplish more ton-miles in the year—in this case more than half as many again—so the higher profit per ton-mile is made on many more ton-miles. Speed thus yields a multiple economy.

Inter-city Application

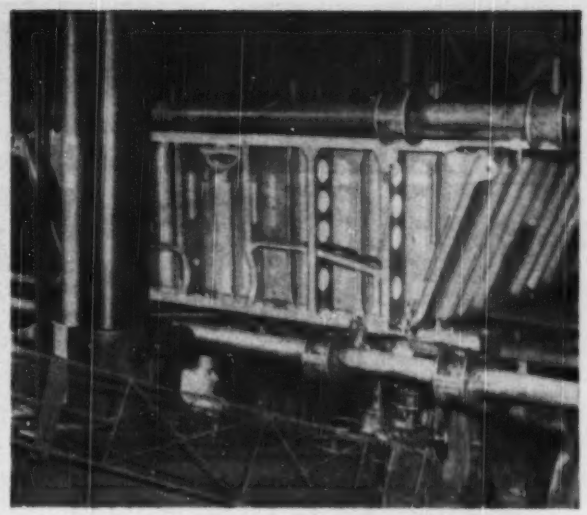
In these calculations the 1,500—2,000-mile stage-length has been taken as being typical. Investigation of lower stage-lengths bears out the opinion which was expressed before the Comet flew, namely, that it would be economical on stages down to 1,000 miles and less.

To many, this will be one of the unexpected lessons of jet transport which the Comet will demonstrate in airline practice as it has done in test-performance analysis. It should be a better profit earner, not only on the trunk stages but also over a wide range of stage-lengths even down towards the inter-city category.

The de Havilland Companies emphasize that all the figures used in these cost calculations are based upon the performance of the Comet as it is to-day; figures more favourable to the Comet should emerge as the developments now in hand materialize. These developments are expected to yield increases in the thrust of the Ghost for take-off and emergency climb, a decrease in specific consumption for cruising, an increase in the all-up weight of the aircraft, and an increase in the internal fuel-capacity.

Jet airliners are more sensitive to air temperature and pressure: the avoidance of take-offs from high and tropical airfields in the heat of the day will yield rewards in take-off weight and payload. There is also the point that the simplicity of the jet aircraft and its power plant will yield other advantages as well as reduced cost of maintenance. Shorter servicing-times should lead to increases in utilization, and the briefer halts, quicker terminal turn-round, and higher regularity must appeal to operator and traveller.

A de Havilland tradition is followed in that the economy of the Comet results largely from simplicity and speed. Still higher cruising speed, calling for severe sweep-back, would have involved technical problems and a heavy penalty from the point of view of economy, which would have made the Comet less attractive as a commercial proposition. It is in conformity with their policy, say the makers, that the centrifugal-compressor turbojet, with single-sided impeller, has been chosen for the Comet.



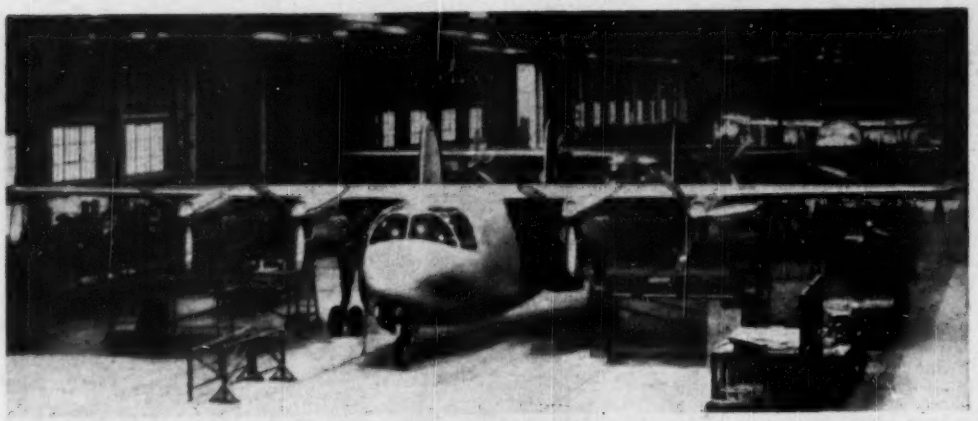
A massive drilling-jig which ensures interchangeability of Comet wings. Wing-root fittings require the drilling of 244 holes in the centre section.

At the present time Sir Frank Whittle, advisor on jet development to B.O.A.C., is visiting the Middle East and India to study airfields in connection with the introduction of the Comet, with particular reference to take-off problems in hot climates and at high altitudes. By the time Comets are introduced on the service, liquid injection—giving some 10 per cent increase in power for take-off—will be a standard provision. The D.H. Sprite rocket motor, produced to assist Comet take-off, is described elsewhere in this issue. On Thursday last, January 26th, Sir Miles Thomas, chairman of B.O.A.C., left London for a four-week visit to Australia and New Zealand, travelling via Karachi, Singapore and Hong Kong. He stated that one of the reasons for his mission also was "in a sense to blaze the trail for the Comet." On reaching Karachi he said that progress with the Comet had been much faster than expected, and the manufacturers were two years ahead of schedule. B.O.A.C. would introduce the Comet on stages of the London-Australia run by the end of 1951. Further notes on Sir Miles's visit appear on p. 153.

FARNBOROUGH FILM

A MAGNIFICENT sound film of the Farnborough Display, produced by the Shell-Mex Film Unit, was shown last week to a small, select audience mainly consisting of S.B.A.C. Council members. The theme is the change-over from piston engines to gas turbines and the majority of the leading types of British aircraft are included. Many of the air-to-air shots, taken from a tail gunner's position, provide intimate glimpses of aircraft head-on, and performing steep turns and rolls.

The photographer, Mr. A. Beadle, of the Shell-Mex Film Unit, is to be congratulated upon the quality of the film, a copy of which has already been forwarded to America at the request of the Aviation Writers Association; it will subsequently go to Canada. Australia and New Zealand will also have the benefit of seeing this outstanding film in the near future.



INDOOR LINE-UP: Marathons on the production line at Reading. Output will continue at the rate of three a month until the forty ordered to date have been delivered. One of these attractive feederliners is now on a sales tour to Australasia and back.

HERE and THERE

R.A.F. Display Again

AS we go to press it is officially announced that the R.A.F. Display—last held in 1937—is to be revived. The venue is to be Farnborough and the date Friday, July 14th, with a repetition the next day in order to allow as many visitors as possible to see the Display. Their Majesties the King and Queen will be present on the first day.

R.A.F. "At Home" Day, which to some extent has taken the place of the R.A.F. Display, will not be affected. It is to be held on Saturday, September 16th, when many stations will be open to the public.

B-29s for R.A.F.

DELIVERY of seventy Boeing B-29 Superfortress bombers, under the terms of the bilateral Anglo-American agreement signed in Washington on January 27th, will begin in April. They will be flown to Marham, Lakenheath and Sculthorpe by U.S.A.F. crews. Mr. Arthur Henderson has stated that "interim" piston-engined bombers or intermediate jet bombers could have been produced in this country only at great expense, and would have become obsolete in a relatively short time. He has further observed that development of such aircraft would have led to further delay in producing the really advanced jet types now in hand.

A. and A. Epicurean E?

A "PROTOTYPE" airmen's mess which, claims the Air Ministry, rivals the most modern catering establishment in structure, equipment and hygiene, was due to be opened yesterday at Boscombe Down by the Secretary of State for Air. There are two large dining halls seating 960, and decorations are in pastel shades.

Man-made Meteorite

WHEN the two-stage V-2 plus *WAC Corporal* rocket was fired to a radio-recorded height of 250 miles a year ago from White Sands, New Mexico, it was not recovered. Now a fragment has been found near the firing-point; it is thought that much of the remainder may have been disintegrated by heat on the descent.

Aircraft Carriers' Cruise

THE spring cruise of the Home Fleet began on Saturday, January 28th, when the fleet carrier H.M.S. *Implacable* (Capt. C. H. Duffett, C.B.E., D.S.O., R.N.), flying the flag of the new Commander-in-Chief, Admiral Sir Philip L. Vian, K.B.E., D.S.C. and two bars, sailed from Portland for Gibraltar. The carriers H.M.S. *Victorious* (Capt. J. A. Grindle, C.B.E., R.N.) and H.M.S. *Vengeance* (Capt. J. W. Cuthbert, C.B.E., R.N.) were among the accompanying vessels.

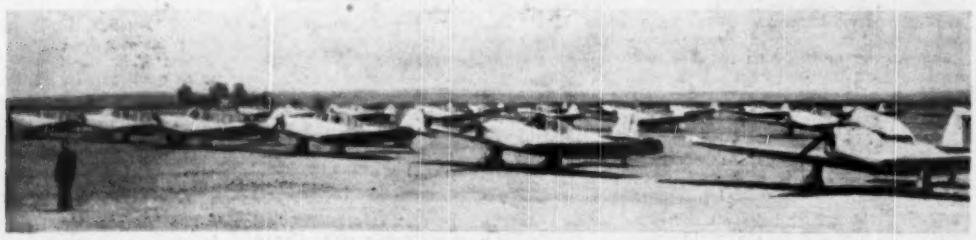
Dorothy Spicer Essay Subjects

SUBJECTS for papers submitted in the 1950 Dorothy Spicer Memorial Essay contest have been announced by the Society of Licensed Aircraft Engineers, as follows: Fire-prevention Equipment, Cabin Pressurization and Heating, Airframe and Engine De-icing, Radio and Radar Equipment. Open to all licensed aircraft engineers in the British Commonwealth, the contest closes on February 28th. Entry forms are obtainable from the secretary of the S.L.A.E., at Finsbury Circus House, Blomfield Street, London, E.C.2. The contest commemorates the famous woman aircraft engineer who met her death in 1946.

Arctic Training

IT has been suggested that specialist officers from the air forces of all the North Altantic treaty countries should undergo joint training in Canada, where stations from the British Commonwealth Air Training Scheme still exist and where the French language is spoken as well as the English.

Operations in arctic conditions would undoubtedly play an important part in any such training. Speaking of the special difficulties of arctic flying, W/C. A. M. Cameron (C.O. of an R.C.A.F. experimental unit) remarked recently that in such areas compasses were unre-



OUTDOOR LINE-UP: Percival Prentices on the airfield at Cordoba, the main training base of the Argentine Air Force. Like the Royal Air Force and the air forces of India and the Lebanon, this service has standardized the Prentice for basic-training purposes.

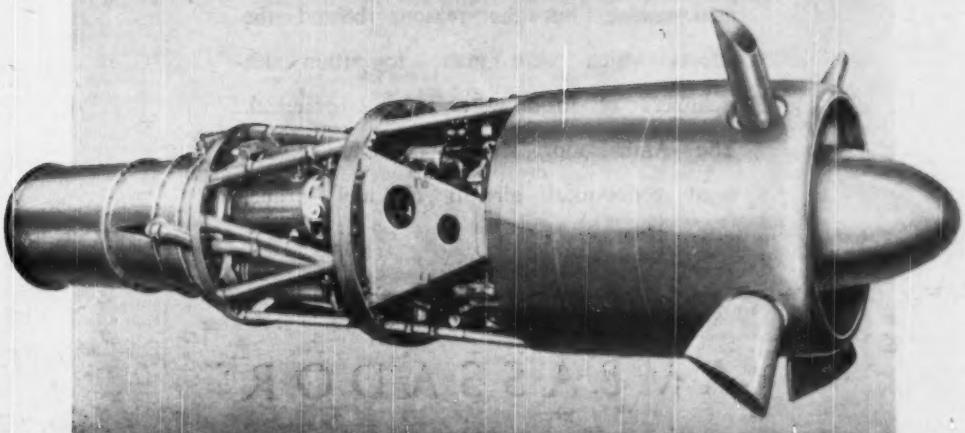
NAPIER NAIAD

PROPELLER TURBINE ENGINE

TOTAL E.H.P. — 1690

WEIGHT — 1095 LBS.

DIAMETER — 28 INCHES



D. NAPIER & SON LIMITED LONDON W.3

The Ambassador probably has a lower relative drag than any other civil aircraft in the world. In itself this is something of an achievement, but the reasons behind the efforts which were made to attain this cleanness of form were entirely practical. The Ambassador should be one of the most economical aircraft on any airline.

AMBASSADOR

AIRSPEED LIMITED · CHRISTCHURCH AND PORTSMOUTH · ENGLAND

In association with the de Havilland Enterprise

HERE AND THERE ...

liable and that navigation was further hampered by the fact that in the winter dusk there were neither stars nor sun. In addition, it was often impossible to see where ground ended and sky began. He also mentioned that in below-zero temperatures man's efficiency was halved, and therefore approximately double the number of personnel would be required for any given duty.

It will be recalled that navigation and and compass-behaviour in polar regions were investigated by *Aries*, Lancastrian of the R.A.F. Empire Air Navigation School, and a report was published in *Flight* of December 5th, 1946.

Two Gliding Classics

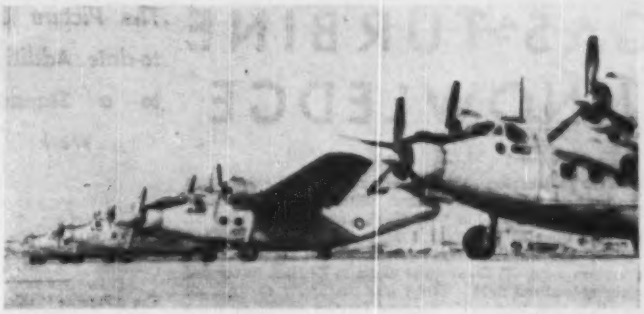
GREAT Hucklow, Derbyshire, will again be the scene of the National Gliding Contests, the B.G.A. having accepted the Derbyshire and Lancashire G.C.'s offer to organize the event, which will be held during the period Saturday, July 29th, to Monday, August 7th, inclusive. Enthusiasts hope that the law of averages, if nothing else, will this year bring them more co-operative weather.

The other major gliding event of the year, already announced, is the International Contest, to be held at Orebro, Sweden, from July 3rd to 16th. At the moment it does not appear that British representation will be strong, though Philip Wills is a likely starter.

Rescue Raiders

IT is learned that the ten YC-125B (Northrop Raider) aircraft earmarked for Arctic rescue work and shown in the picture above are to have airborne blower systems for engine pre-heating on the ground. A contract to construct the equipment and install it as the ten aircraft come off the production line has been given by the U.S. Air Force to Temco, the Texas Engineering and Manufacturing Company.

It may be recalled that the Canadair Company has obtained a licence to build Raiders for civil freight and passenger work. This three-engined assault transport has landing and take-off characteristics which fit it for operation from small areas. Canadair have not as yet reported receiving orders for Raiders, or the commencement of their construction.



SPECIALISTS: Of 23 Northrop YC-125B assault transports (five of which are seen above), ten are being equipped for arctic rescue. As related on this page, they will have built-in engine pre-heating equipment. Wheel/ski undercarriages will be fitted.

Helicopter Forum

THE joint sixth annual forum of the American Helicopter Society and Institute of Aeronautical Sciences will be held in Philadelphia on March 30th and 31st. There will be four sessions, covering theory, design, operation and economics. Mr. R. H. Prewitt (Prewitt Aircraft Co.) will be chairman and Mr. Hugh J. Mulvey (Piasecki Helicopter Corp) vice-chairman.

In Memory of Don Robins

MANY people in civil aviation who knew the late Capt. P. D. Robins must have been moved by the tribute paid to him in a B.B.C. feature programme—his life story—on January 24th. An R.F.C. pilot in the first world war, he joined Air Transport and Travel, Ltd., at their inception, and flew on the London-Paris service; later, flying as an Instone Air Line pilot, he was one of the first to wear the newly introduced air transport uniform. A contemporary of Lawford, Shaw, Campbell-Orde, Holmes, Macintosh, Olley, Wilcockson, Hope, Rogers and other old-timers, he flew D.H.4a, 16, 18, 34 and similar pioneer commercial types.

In 1923 Robins entered the Church, and his subsequent good works became legendary; he was known as the "Dick Shepherd of the North." Chaplain to C.A.P.A.N. until the outbreak of the second world war, he died of a sudden illness in 1948.

NEWS IN BRIEF

ONE of the Monte Carlo Rally competitors was Mr. Frank D. Cooper, whose 2½-litre Riley bears the registration mark KLM1. Royal Dutch Airlines "adopted" him, their cars and officials piloting him through towns.

* * *

A.V-M. K. G. Leask, C.B., M.C., ret., formerly Director-General of Engineering, Air Ministry, has been appointed manager of de Jersey and Co. (Finland), Ltd., in Helsingfors, and has taken up his residence there. He will be concerned with the firm's exports—mainly engineering products—from this country.

* * *

Teddington Controls, Ltd., Merthyr Tydfil, South Wales, have published a well illustrated list of their basic products. The company specializes in devices for the automatic control of temperature and pressure as applied to aircraft, and the handbook should be found useful for reference in detail design offices.

Mr. Robert B. Hotz, lately news editor of *Aviation Week*, has been appointed public relations manager to the Pratt & Whitney division of United Aircraft Corporation.

* * *

The secretary of the West London Aviation Club, which recently held its first annual general meeting, states that new members will be welcomed: the club meets each Friday (7.30 p.m.) at Beaufort House, Lillie Road, Fulham.

* * *

William Jessop and Sons, Ltd. (whose aircraft steels, particularly of the heat-resisting variety for gas-turbine components, are well known) announce the appointment of Mr. D. W. Hammond as works director and Mr. C. Whitaker as production manager.

* * *

High Duty Alloys, Ltd., recently produced for their business visitors a guide to the location of their various factories; now they have published a most entertaining brochure concerning Moresby Hall, the lovely old manor which they maintain as a guest-house for visitors to their Distington, Cumberland, works.

* * *

Mr. Y. Galitzine has been appointed assistant to the managing director of Hunting Air Travel, Ltd., Mr. J. L. Smith. He will remain editor of the *Hunting Aviation Review* and will continue to carry out certain of his Press liaison duties for the Hunting Group. For the time being, his office is at the London H.Q. of Hunting Air Travel, Ltd., at 20, Pall Mall, S.W.1.

ODDITY demonstrated by Bill Star at the recent Miami display. Span (believe it or not) is nine feet.

GAS-TURBINE KNOWLEDGE

The Picture Up-to-date: Additions to a Standard Work

The difference in thickness between the first (1942) and latest editions is visual evidence of the speed of gas-turbine progress.

THE publication date of this issue of *Flight* is also that of the fifth and latest edition of *Gas Turbines and Jet Propulsion*,* by G. Geoffrey Smith, M.B.E., Editorial Director of *Flight*.

When the first edition of this work appeared—in December, 1942—it stood quite alone in its then novel and highly specialized field. There was, naturally enough, an immediate and large-scale demand for the book; so much so, in fact, that the second edition was issued only six months later. And so it has gone on through nearly a decade, and with the passing years have appeared new, larger, more comprehensive and better-produced editions—and second and even third reprintings of those editions. In each new issue, the standard set by the first edition has been enhanced and, as a result of this continued progress, it is as true to say of to-day's fifth edition as it was of the 1942 first edition, that in content, technical quality, comprehensiveness and lucidity, *Gas Turbines and Jet Propulsion* is a pioneer work. In this connection, the world-wide recognition of its merit led to previous editions being printed in other languages, and now this fifth edition also is to be published in the United States, France, Holland, Italy and Spain.

Traditions Established

In his foreword to the new edition, Dr. H. Roxbee Cox, Ph.D., D.I.C., B.Sc., M.I.Mech.E., F.R.Ae.S., Past-President of the Royal Aeronautical Society and Chief Scientist to the Ministry of Fuel and Power, states that "gas-turbine history is so short that one does not expect to find traditions in it. One that seems firmly established is this book." He also notes how each successive edition has given additional information, building up an ever-more-complete picture of the possibilities of the gas turbine as applied to aircraft. This is especially true of the new edition for, apart from revision and expansion of existing chapters, no fewer than five entirely new chapters have been included. Among these additions, those dealing with rocket propulsion and with turbines for road vehicles will doubtless prove to be extremely rich hunting-grounds for all readers of the book, the technician, designer, student and business executive alike.

It is, of course, the extraordinary comprehensiveness of its coverage that makes the new edition such an invaluable source of reference to engineering executives, airline operators and civil and military authorities in all countries, as well as making it a cardinal textbook for universities, technical academies and Government establishments. In its 386 pages are included over 350 illustrations and, over and above the discussion of turbine design and manufacture, an exhaustive appraisal of every known aircraft gas-turbine unit is given, together with all essential particulars of every known aircraft employing turbojet or turbo-prop propulsion.

The views of leading designers and technologists on various relevant aspects of turbine propulsion and aircraft, as expressed in papers delivered before learned societies, are collected in the copious appendix for convenient reference.

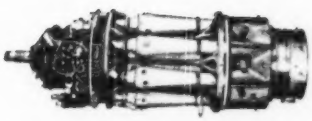
The contents include:—

Propulsion by Jet Reaction; Thrust and Performance; Early Projects; Jets or Airscrews; Gas-turbine Components; Combustion Systems and Equipment; Metallurgical Problems; British Gas Turbines; American Gas Turbines; Germany: Aircraft and Turbines; Canadian and European Turbines; Testing and Maintenance; Turbine-propelled Aircraft; Aerodynamic Problems; Tailless Aircraft and Flying Wings; Compounded Units; Ramjets and Pulsejets; Rocket Propulsion; Closed-cycle Gas Turbines; Turbines for Road Vehicles; Adoption and Progress; Appendix: Notable Views on Turbine Propulsion; Index.

* *Published for "Flight" by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Price 21s. (postage 9d).*

TWO THOROUGHBREDS FROM THE EASTLEIGH STABLE

Continued progress with the Cierva Air Horse is emphasized by this recent photograph showing the first and second machines. The latter, which can be seen "ground running," is expected to make its maiden flight within the immediate future.



Four "Bristol" **THESEUS**

Propeller-turbines, developing

10,000 h.p., power the **HERMES V**

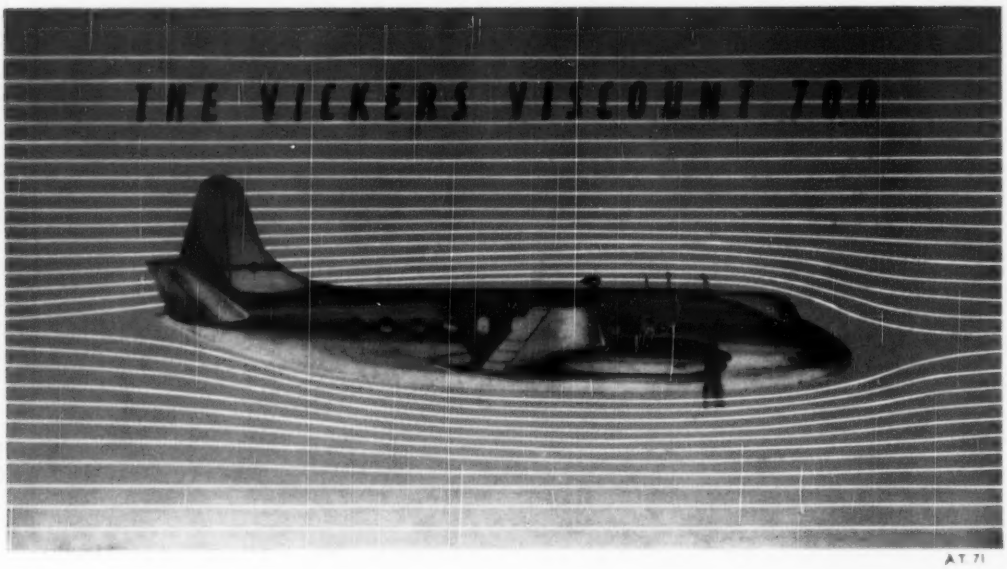
and make possible still further

progress in speed and passenger

comfort in this famous series of

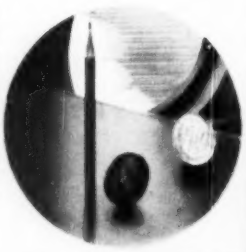
Handley Page aircraft.

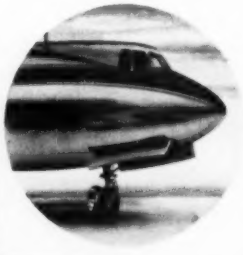
THE *Bristol* AEROPLANE COMPANY LIMITED · ENGLAND



An aircraft that crews will want to fly

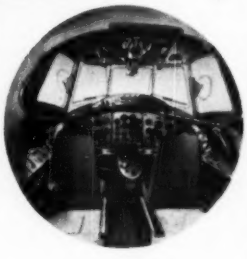
Crews are going to like the *Viscount* for her low noise level and lack of vibration. Flying on four smooth propeller-turbines will be a holiday from travel fatigue. Pressurization, temperature control, and air-conditioning complete the crew's comfort.





As an engine is cut she still flies steadily. With two out on one side she can easily be held right through the speed range without re-trimming the spring tabs. High-lift flaps allow low-speed landings in a short distance, short take-offs, tighter circling.

Pilots flying this new aircraft for the first time will expect to find her different to handle. The only difference is that she handles more easily. Stick loads are light, stalling characteristics excellent. She can take off on three and fly on any two of the Rolls-Royce 'Darts'.



The *Viscount* has a well planned, comfortable cockpit — uses low flash-point kerosene carried in crash-proof tanks . . . has a simple, effective, thermal de-icing system. With safety for ease of mind, smoothness for ease of body — crews will be glad to say, "We're off for a conversion course on the *Viscount*!"

THE FIRST PROPELLER TURBINE AIR LINER

VICKERS-ARMSTRONGS LIMITED

Vickers House · Broadway · London · SW1

CIVIL AVIATION NEWS

SURVEY PRINCE: The first production version of the Percival Prince as adapted for aerial survey duties was due to leave Luton airport yesterday for work in the Middle East on behalf of Hunting Aerosurveys, Ltd.

SOLENT WITHDRAWAL

STRONG criticism of B.O.A.C.'s intended withdrawal of Solents from service was recently made by a deputation representing the staff of the Corporation's No. 4 Line, who felt that the decision called for a personal interview with the Minister of Civil Aviation, Lord Pakenham. The members of the deputation were outspoken in their view that the policy was mistaken on both national and operational grounds.

Though he promised a considered reply in due course, the Minister's reaction was not encouraging. He expressed his "complete confidence in the commercial judgment of B.O.A.C." and said that he was not aware of any national consideration which in this case would lead him to request the Corporation to reconsider its decision.

While realizing that B.O.A.C.'s decision was probably necessary in the interests of operating economy, *Flight* must nevertheless reiterate the opinion (which is shared by members of the staff of B.O.A.C.) that operational knowledge of the flying-boat is of inestimable value, the loss of which the United Kingdom and Dominions might have cause to regret. It is hard to reconcile the decision with the fact that the Minister has re-emphasized the intention of the Government and B.O.A.C. to go ahead with plans for production and operations of the Saunders-Roe Princess boats.

FUTURE CIVIL PILOTS

FIRST signs of implementation of the recommendations of the Wilcock Report on recruitment, training and licensing of personnel for civil aviation, which was presented to Parliament last July, are evident in the announcement of a scheme, to be introduced almost immediately, whereby suitable pilots holding short service commissions will be selected well in advance of their release date and given facilities for obtaining their civil licences whilst still serving. In the Royal Air Force these facilities may include special postings to Commands where more appropriate experience can be obtained.

To determine the extent of the possible pilot-shortage and to enable effective action to be taken before it reaches serious proportions, the M.C.A. is shortly to invite all operators to submit a forecast of their individual requirements—up to two years ahead, if possible. The present intention is that these figures should be reviewed every six months so the trend of employment may be taken into account.

In announcing the new arrangements, the M.C.A. states: "Although it will not ensure that an adequate number of experienced pilots will always be available to the industry, the scheme for pre-selection will enable a fairly accurate assessment to be made of the number of pilots likely to be forthcoming from the Services."

Although this scheme should, in some measure, alleviate the situation envisaged in the Wilcock Report, it is apparent that even the M.C.A. does not consider such a remedy completely adequate. It will be recalled that the Committee's report recommended a State-aided training scheme to provide scholarships for 40 per cent of the pilot entrants required from civil life. In a memorandum to the report, however, Lord Pakenham stated that he did not accept this recommendation in principle. In our own view, the Ministry's action in announcing the present scheme emphasizes the fact that a shortage of the proportions envisaged does in fact exist, and that further consideration should be given to the implementation of the State-aided training plan. We may now, perhaps, look forward to increasing co-operation, in all branches, between Service and civil flying interests to their mutual benefit.

CHAIRMAN'S TOUR

THE chairman of B.O.A.C., Sir Miles Thomas, left London last Thursday for what he described as a "Comet trail-blazing tour." He is visiting Karachi, Singapore, Hong Kong and destinations in Australia and New Zealand.

He reached Karachi on Saturday, where he made the welcome announcement that progress with the de Havilland Comet was two years ahead of schedule, and that, starting with a short-stage service, probably as far as Cairo, B.O.A.C. would first introduce the aircraft on the London-Australia route. By the end of 1951, he expected, jet airliners would be flying regularly as far as Karachi.

Before leaving London, Sir Miles had explained the objects of his tour, saying: "My mission is three-fold. First, I intend to make a personal on-the-spot check that all possible economies are, in fact, being made on B.O.A.C.'s Far East routes, where we have substituted Argonauts for the old, slower flying boats; secondly, I shall talk to the head officials associated with other Commonwealth airlines with a view to strengthening our joint operations between Britain and Australasia, including the westabout route across the Pacific and Canada. Thirdly, I am in a sense blazing the trail for the Comet."

On the general subject of B.O.A.C.'s progress, Sir Miles said that it could now be accepted that the major part of the reorganization programme had been accomplished. Since March, 1947, the staff had been reduced from 24,464 to 17,250—a reduction of over 27 per cent; concurrently, aircraft

CIVIL AVIATION NEWS . . .

mileage and passenger freight capacities had been increased.

The chairman thought that the prospects for 1950-51 were brighter and that big economies resulting from the reorganization were already becoming evident. Mentioning that the fluid international situation in South East Asia made it increasingly important that there should be a strong and efficient air service between the homeland and the Empire territories in the eastern hemisphere, Sir Miles said: "In this connection much preparatory work for Comet operations has to be done. Problems of aerodrome lengths, high altitude, weather and wind studies, the effect of humidity and tropical heat on jet performance, especially at take-off with full loads, have all to be motivated."

Probably underlining the implications of Sir Miles Thomas' statements is the fact that Sir Frank Whittle is now touring India, where he is conferring with the C.-in-C. of the Royal Indian Air Force and officials of the civil aviation directorate of the Indian Government on such matters as the operation of jet airliners and its effect on navigational and landing aids and ground-control facilities. Considerable modifications will be necessary at most airfields before Comets can be successfully routed through India.

LIGHT-AIRCRAFT SAFETY

IN M.C.A. Circular No. 9/1950 reference is made to the number of accidents which have recently occurred to light aircraft when taking-off from fields, "largely due to failure on the part of the pilots concerned to observe the elementary requirements of airmanship." Pilots operating from confined spaces are recommended to pay particular attention to the length available for take-off and to the height of nearby obstructions in relation to the published performance of the aircraft. Attention is drawn to the fact that take-off performance can be adversely affected by a number of factors such as long grass, rough surfaces, uphill slopes, downdraughts (which may exist in the lee of clumps of trees, buildings and ground undulations), and also the effects of high summer temperatures. The importance of familiarity with the correct use of flaps for take-off and loading restrictions is also stressed.

DEVELOPMENT IN ITALY

THE Italian air transport industry is showing a strong tendency towards centralization. Instead of the 11 companies which were operating in 1947, there are now only three major airlines, Alitalia, Ali-Flotte Riunite and L.A.I. A further measure of centralization may this year reduce the number of two. Approximately 50 per cent of air traffic in Italy is handled by national companies. Plans include the inauguration of Rome-New York and Rome-Mogadishu services.

Much reconstruction has been accomplished at various airfields throughout the country, and the airport at Ciampino is now considered one of the best in Europe. Plans for the new international airport at Fiumicino, near Rome, are well advanced, and its construction is expected to begin in the near future. During the past year the route network of combined Italian airlines totalled 61,765 km. In the same period a total of 7,784,080 aircraft-kilometres were flown and 166,852 passengers transported, while figures for mail and cargo amounted to 921,234 kg and 3,403,521 kg respectively.

PROCTOR PRECAUTIONS

IN *Notice to Licensed Aircraft Engineers and Owners of Civil Aircraft No. 34*, the A.R.B. calls for an immediate inspection of the mainplane spars of all Proctor IV and V aircraft to ensure that there are no defects in the timber and that all glued joints are sound. A structural failure in the air in Proctor V aircraft was recently reported and these precautions have been ordered pending the result of the investigation. The notice also stresses that Proctors are classified in the "normal category" only and must not be subjected to evolutions which might lead to abrupt variations of attitude. The new instruction cancels an earlier issue of the same notice arising from the failure of a Proctor IV.

AMBASSADOR IN EIRE

THE second prototype Ambassador was recently demonstrated to Aer Lingus at Collinstown, near Dublin. Flown by Mr. G. B. S. Errington, Airspeed's chief test pilot, accompanied by Mr. P. E. Gordon-Marshall, the sales director, the Ambassador spent three days in Eire. During this period a return trip was made to Shannon airport, with Aer Lingus directors and officials of the Department of Industry and Commerce on board. Several Aer Lingus pilots had the opportunity of handling the aircraft in the air on the demonstration flights.

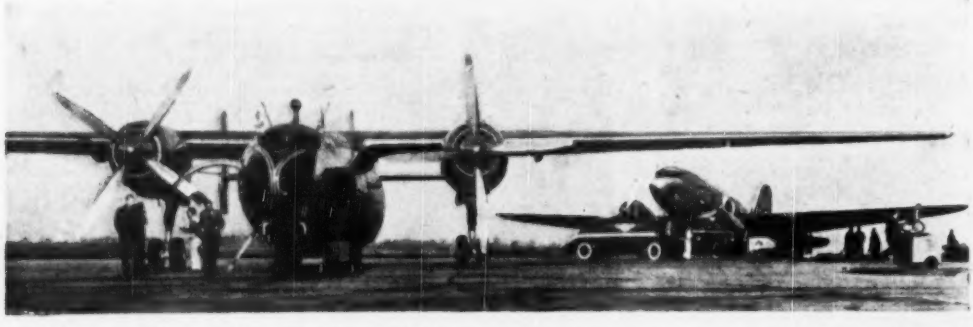
Although the Ambassador was being flown at relatively low levels throughout its tour, the point-to-point speeds recorded were said to have been very encouraging when related to the previous test figures. On the outward journey the flight between Hurn and Collinstown was made in 1 hr 4 min, an average of 246 m.p.h., including climb and descent—this in spite of the fact that the aircraft cruised at only 8,000ft and the engines were being run at less than 60 per cent M.E.T.O. The average speed for the return trip was 241 m.p.h., and the average T.A.S. during each flight 250 m.p.h. The Ambassador's published cruising speed for these power and height conditions is, in fact, exactly 250 m.p.h.

The second prototype is equipped with the Decca Navigator system, and all over-weather position-finding was carried out with this equipment, which proved itself to be extremely accurate and is said to have given good results even on the west coast of Eire, nearly 400 miles from the master transmitting station.

Aer Lingus at present operates a fleet of 13 DC-3s and has an impressive record of passenger totals and aircraft utilization. Last year the company carried 193,000 passengers and over 1,700,000 kg of freight. The longest route operated is that from Dublin to Amsterdam *via* Manchester—the type of service for which the Ambassador should be eminently suitable.

SIAMESE SERVICES

TRANS-ASIATIC AIRLINES, a company operated by the Government of Thailand, is expected to commence regular services between Bangkok and London and Bangkok and Los Angeles. Mr. D. S. Starr, vice-president of the company, has completed a three-month visit to New York, where he has been negotiating for the purchase of four Skymasters to be used on the new routes. Mr. Starr states that operations will probably commence within four or five months and that the services will be flown over both the Atlantic and Middle East routes. Further negotiations are in progress to purchase six Saab Scandias, which will be used as replacements for the aircraft now in service in Thailand and Burma.



AMBASSADOR TO EIRE: The Airspeed Ambassador which, as reported on this page, was recently demonstrated to Aer Lingus, is seen here at Collinstown, Dublin's airport. To the right is an Aer Lingus Dakota.

"THE WORLD'S FIRST"

Capt. R. Rymer.

THE world's first endorsement for turboprop aircraft has been recorded on the "B" licence held by Capt. R. Rymer, B.E.A.'s Chief Base Training Captain at Northolt. On behalf of B.E.A., Captain Rymer has been working in close co-operation with Mr. "Mutt" Summers, Vicker's chief test pilot, on the Viscount handling trials, accumulating to date a total of 30 hours' flying on this type. He recently took the A.R.B. tests on the Viscount and was duly accorded the distinction of being the first pilot permitted to fly the aircraft commercially. During the war he was flying for Coastal Command and as an instructor before joining B.E.A. in 1946; he has a total of approximately 5,000 flying hours.

I.C.A.O. AIDS REPORT

THE report of the I.C.A.O. Aerodromes, Air Routes and Ground Aids Division, which met in Montreal last November has now been published. Three main problems were studied, those of approach lighting and day marking-aids for airfield approach; standardized marine-base lighting and associated day marking; and the formulation of technical specifications for aviation-light and surface-marking colours together with specifications for beam characteristics of beacons and of flashing amber lights.

The report recommends two approach-lighting systems. The first, designed to assist pilots approaching in visibility of down to half a mile, is to be a single row of lights extending from the runway threshold outwards for a distance of at least 3,000ft. Each light is to be not more than 300ft from the next, and the row is to be positioned either along an extension of the runway centre-line or to the left of, and parallel to, the extended centre line; but it must not be more than 8 metres from the left-hand edge of the runway. The installation of the second system was recommended for all runways provided with any type of radio navigation aid to final approach and landing.

For this installation, designed to afford guidance to aircraft making instrument approaches in minimum visibility, it was decided that the three systems which have to date been developed by France, Britain and the United States were all satisfactory. It was recommended that the configuration of the second approach-lighting system should be in conformity with one of the three designs. It was thought desirable, however, that one line-and-bar system should be developed out of the two proposed by France and Britain; these, almost identical in principle, differed in configuration.

On the problem of marine bases it was agreed that lighting should be clearly distinguishable from that of a normal airfield to avoid the possibility of a landplane pilot putting down on water. The colour characteristics of water lighting were selected on this principle rather than with a view to providing maximum light intensities, and a number of standards and recommended practices were agreed upon. It was decided that day marking of marine bases could generally be affected by conspicuously marking each light-support. Additional specifications were drawn up for "aviation colours" for lights of fixed and variable intensity; they included guidance as to designs which would ensure discrimination between yellow and white.

BREVITIES

WITH the object of entering the executive-transport and feederliner market in the U.S., the de Havilland Company is in process of completing American certification for the eight-passenger Dove. To date, nearly 300 Doves have been sold throughout the world.

* * *

Visitors to the Empire Games in New Zealand have created a steadily increasing backlog of passengers for Tasman Empire Airways; the figure now stands at 650. The company has been forced to charter Skymasters to meet the heavy traffic.

* * *

A.O.A. passengers arriving in New York from overseas points and requiring direct connections on American Airlines to destinations in the U.S., Mexico and Canada, will be provided with free limousine service from the new international terminal at Idlewild to La Guardia.

* * *

During 1949 American Overseas Airlines carried more passengers and cargo than at any time in its history. Passengers totalled 97,200—21.2 per cent more than the previous year. Cargo figures reached 12,500,000 lb, an increase of 64.6 per cent, and mail amounted to 1,900,000 lb, an increase of 35.4 per cent. The company flew a total of 202,100,000 passenger-miles and 28,200,000 ton-miles during the year.

* * *

Mr. Brian Oakley, who has been commandant of Renfrew Airport for over two years, is now commandant of Northolt. He succeeds A.V-M. S. P. Simpson, who (as mentioned in *Flight* last week) becomes a Divisional Controller of the M.C.A. The Ministry also announces the appointment of Mr. G. J. H. Jeffs as airport commandant at Prestwick in succession to G/C. J. A. McDonald, who has been appointed a divisional operations officer.

* * *

An indication of the rate at which the carriage of air freight is increasing can be obtained from figures reported by Australian National Airways for the period from 1946 to June, 1949. From £4,413,686 the total had increased to £13,769,712 by December, 1947, and by June, 1949, had reached £19,930,520. A.N.A. is now using three DC-3s and three Bristol freighters exclusively for such traffic. The company has also renewed its application to run a Sydney-Christchurch Skymaster service three times weekly.

* * *

A considerably enlarged fourth edition of "*A Guide to the Aircraft Maintenance Engineer's Licence Examinations*," revised in accordance with the latest M.C.A. and A.R.B. orders and requirements, has been published by the Society of Licensed Aircraft Engineers. The section containing specimen examination papers, in particular, has been augmented by the inclusion of various "X" Licence subjects. Copies of this informative handbook, price 6s, are obtainable from the Society's head office at Finsbury Circus House, Blomfield Street, London, E.C.2.

* * *

From January 15th Boeing Stratocruisers have been operating on the California-Hawaii segment of the United Airlines system. Seven round-trip flights weekly are flown between San Francisco and Honolulu, and the flight from the mainland to Hawaii is completed in 9½ hours.

* * *

All who served in any capacity in the old Plough Lane buildings at Croydon Airport before the move (in December, 1927), to the present buildings, are eligible for a reunion dinner which it is proposed to hold at the Aerodrome Hotel on Friday, March 17th. Tickets (price 7s 6d) are obtainable from Mr. Leslie Pace, c/o B.O.A.C., London Airport, Heathrow. Admission will be strictly limited to those who can provide the necessary proof of eligibility.

* * *

The privately owned company, Malayan Airways, has now increased its unduplicated route mileage to 6,504. The fleet consists of seven DC-3s, and the equivalent annual utilization per aircraft, with no scheduled night flying, has now reached a figure of 1,666. Services are operated to Sarawak, North Borneo, Burma, Thailand, Indo-China and, domestically, within Malaya. Facilities are also provided at Singapore for a number of other operators, including B.O.A.C. and Pan American Airways.

* * *

Following the conclusion of the agreement with Ceylon, aviation circles in Australia hope that similar arrangements may be made with the Philippines, Holland, India and Pakistan which for some time have been anxious to operate services to Australia under such reciprocal agreements. It will be remembered that in pre-war days the K.L.M. service to Australia was noted for its efficiency; its revival would be welcomed by commercial interests who consider that Australia should adopt the same policy towards foreign aircraft as towards shipping.

* * *

Commercial development of Air France since the end of the war has been recognized by the award of the Kulhman medal. The award is made annually to the French enterprise which in the opinion of the judges, a group of Lille industrialists, has shown the greatest all-round increase in the scope, range and efficiency of its activities over the pre-war period. An indication of this increase in the case of Air France can be seen in the number of revenue aircraft-kilometres flown.

CIVIL AVIATION NEWS . . .

which in 1938 was 10,874,893 and in 1948, 37,475,894. The number of passengers carried has risen from 104,424 to 563,948.

* * *

Company officials recently visited Belgrade to discuss plans for the proposed Pan American feeder service. The airfield at Belgrade is at present severely restricted in size and landing aids; it is reported, however, that Yugoslavia will ask for a substantial U.S. loan to permit expansion of civil aviation facilities.

* * *

The Italian company, Alitalia, has now opened a booking and enquiry office in London. All applications for reservations can now, therefore, be made direct to the company at the new address—Dorland House, 14-16, Regent Street, S.W.1.

* * *

The B.O.A.C. mid-Atlantic route from London to Bermuda and Nassau *via* Lisbon and the Azores, which was closed after the loss of the Tudor IV *Star Tiger* in January, 1948, is to be reopened on March 2nd. The new service will connect at Nassau with present York flights to Kingston, Panama, Lima and Santiago. Constellations will be used, and the service will be flown twice weekly during March, increasing to four times weekly in April. B.O.A.C.'s Constellation service between New York and Bermuda, which is said to have been operating at an annual loss of £500,000, will be withdrawn on March 31st. On the south Atlantic route *via* Dakar, Natal, Rio de Janeiro, Montevideo and Buenos Aires to Santiago, Argonauts will be introduced progressively to replace the existing York services; the replacement should be complete before the end of March.

At the beginning of 1950 a total of 219 Lockheed Constellations were either flying or on order for 14 major airlines throughout the world and for the U.S. military services. Of this total, 100 aircraft are of the "749" series. For comparison, the total number of DC-6s in operation or on order now stands at 174.

* * *

Beech Aircraft Corporation announces production of the new model B-35 Bonanza. This latest version incorporates several refinements, among which are increased horse-power rating at take-off, a new electrically controlled variable-pitch airscrew, increased flap travel and speedier retraction of the undercarriage.

* * *

During the winter season, when many aircraft owners and operators carry out C. of A. overhauls, procuring the necessary spare parts sometimes involves difficulty. Weston Airways, Ltd., of Weston-super-Mare, announce that they hold large stocks of airframe and engine parts for a variety of types, together with a wide selection of aircraft materials for immediate issue.

* * *

The State Department has announced that it will not designate further American airline companies for expanded operations in Canada until a Canadian company has been granted reciprocal rights for the Montreal-New York route. This decision arises from the dispute between Colonial airlines and the Canadian Air Transport Board (on behalf of Trans-Canada Airlines) as to the right of the former to retain the monopoly of this route. The U.S. Lower Courts decided that the two companies should operate this service mutually, but the decision is to be re-examined by the Supreme Court on February 17th.

FROM THE CLUBS

DURING 1949 the Cambridge Aero Club flew 1,307 hours; this total was achieved with two Tiger Moths and one Autocrat, a further Tiger Moth being held in reserve. The comprehensive training syllabus included aerobatics, instrument flying, night flying and a considerable amount of cross-country work. Twelve members made their first solos during the year and five "A" licences were obtained before the new Private Pilots' Licence was introduced. Subsequently, five members qualified for the new licence. M.C.A. approval for the 30-hour course was received in October.

Seven private owners made use of the servicing and housing arrangements at Cambridge, and numerous visitors took advantage of the facilities available.

* * *

IN December, several members of the West Riding Aviation Centre ventured into the air whenever the weather permitted, but the absence of any visible horizon seriously curtailed dual instruction. Mr. K. O. Crossley has recently obtained his instructor's endorsement and is now available to give dual instruction. No new members were enrolled during the month.

Since the granting of the full catering licence, a number of successful functions have been held in the club-house, particularly during the Christmas period.

Permission has been received for the operation of scheduled services from Leeds to London and Jersey during the summer season. These flights are due to begin on April 1st; the Jersey service will be flown three times weekly, with a stay at Guernsey if required.

THE complete overhaul of a very dilapidated pre-war Aeronca 100 (38 h.p. J.A.P.) represents a praiseworthy effort on the part of two young students, Mr. P. Simpson (the registered owner) and Mr. A. Ord-Hume, of Pinner, Middlesex. The aircraft was purchased in 1947 and the work, which included complete fabric re-covering, was carried out during vacations in the owner's garage. Application for a renewal of C. of A. has been submitted, and flight trials were carried out at Elstree by Mr. J. K. Keats, C.F.I. of the United Services Club, who considered the aircraft satisfactory in every respect. A second aircraft on the Simpson-Ord-Hume assembly line is a Luton Minor, on which the two enthusiasts hope to start work as soon as A.R.B. approval of the Aeronca is notified.

* * *

THE Wiltshire Flying Club recorded a total of 75 hours during the six days ended January 19th, a notable achievement for the winter season. This figure, which included dual and solo flying, was attained with only four club aircraft. During the period in question, five pupils successfully completed their first solos.

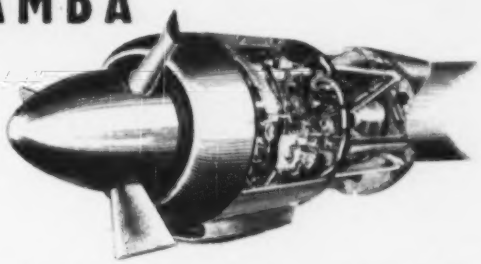
* * *

IN view of its impending departure from Ratcliffe Aerodrome on March 31st, the Leicestershire Aero Club is organizing a farewell party for Saturday, March 11th. Visitors from other clubs are invited to attend for afternoon tea, to be followed by a social and dance. Operations from the club's new airfield at Rearsby should commence on April 1st; flying at Ratcliffe is to cease on March 15th.

The Aeronca 100 (38 h.p. J.A.P.) which, as related above, has been restored to life by two youthful enthusiasts, Mr. P. Simpson (21), the owner, and Mr. A. Ord-Hume (17). The aircraft now awaits renewal of its C. of A.

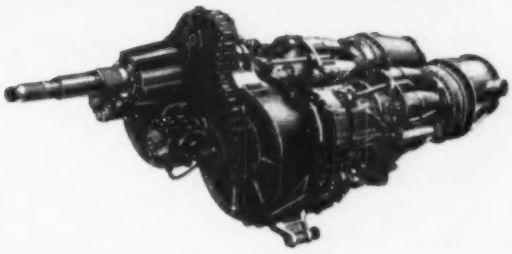
British prop-jet progress leads the World

MAMBA



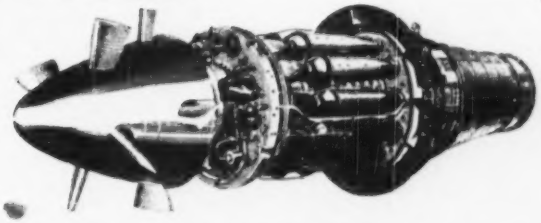
Over 8,000 hours development running and flying experience have gone into the development of the Mamba. Increased power has been achieved without any increase in weight or diameter. Completed successfully 150 hour civil and military type tests, 500 hour sealed endurance test flying in five types of single and multi-engined aircraft.

DOUBLE MAMBA



The Double Mamba with independent contra-rotating props is the ideal power unit where economical cruising and high reserve of power are required.

PYTHON



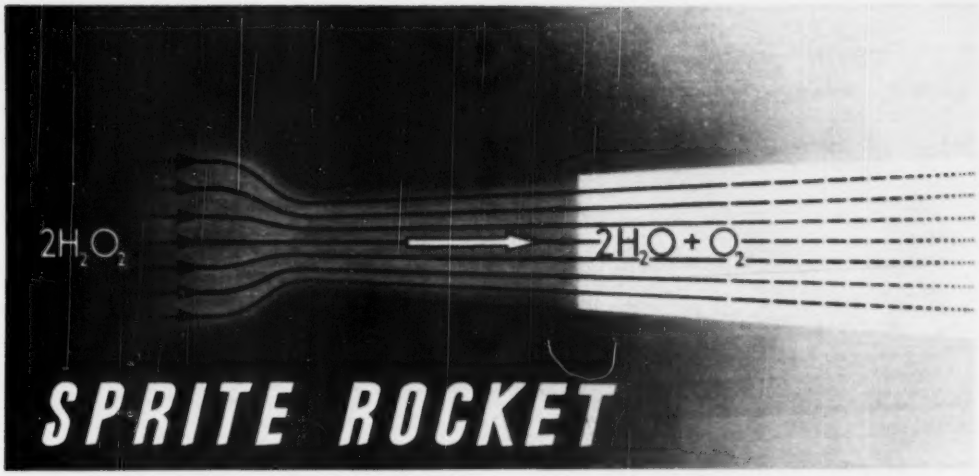
One of the world's most powerful aero engines—over 4,110 equivalent s.h.p—the Python is the first prop-jet in quantity production. Passed 150 hour combined civil and military type tests August 1949 . . flying in the new Wyvern Naval Strike Fighter August 1949.

ARMSTRONG SIDDELEY MOTORS LTD

PARKSIDE, COVENTRY • BRANCH OF THE HAWKER SIDDELEY GROUP

CHIPMUNK

The new de Havilland basic trainer, logical successor to the Tiger Moth and powered by the famous Gipsy Major engine



Details of the de Havilland Rocket Unit for Assisting Comet Take-off

ALTHOUGH the words "for assisting Comet Take-off" in the sub-heading above are essentially true, their implication could be misleading. Tropical temperature—for, of course, the gas turbine is particularly sensitive to ambient temperatures—coupled with a high elevation (such as exists, for example, at Nairobi) can mean that the basic power available for take-off is reduced by as much as 25 per cent. If, therefore, in a four-engined aircraft, one turbojet "dies" at take-off, the available power remaining to meet I.C.A.O. requirements is, effectively, that of only two.

Thrust boosting can be obtained by water injection and by afterburning, but whereas all types of air-consuming engines suffer a loss of power output with decrease of atmospheric density, the rocket motor shows a slight improvement in performance under these conditions. Furthermore, there is virtually no limit to the extra thrust which can be obtained from rockets of suitable design. The high fuel-consumption of the rocket is relatively unimportant in the take-off assistance application, for the whole fuel load is consumed in a matter of seconds, and although rocket propulsion at low speeds results in poor (rocket) efficiency, the characteristic high thrust from small, light units offers great advantage.

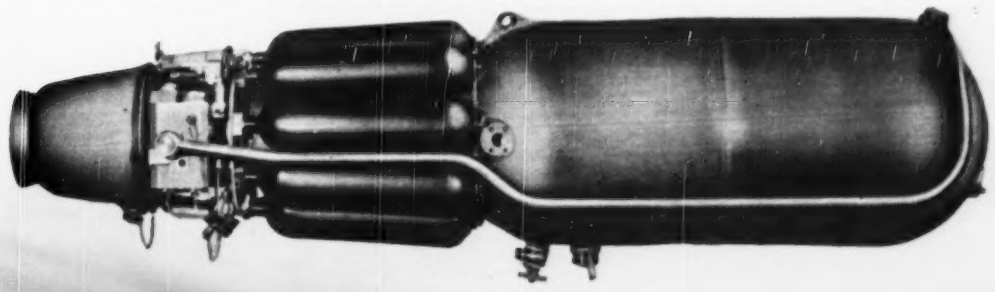
So far as the ordinary man in the street (at least of London) is concerned, aeronautical rocketry conjures up bitter memories of V-2s. All in all, therefore, it is not to be wondered at that the immediate passenger-reaction to the use of rockets for civil aircraft is somewhat reserved, if not actually wary. This unease may well be largely the outcome of ignorance, particularly in view of the general impression, sustained by the annual Guy Fawkes festival, that rockets involve bangs and cracks and showers of sparks. It may, therefore, be a matter of surprise to many people to learn that all that comes out of the Sprite is a jet of steam and oxygen; and although it is called superheated steam—which really means that it is of a higher temperature than the liquid from which it is formed—the actual temperature is not high; it is, in fact, only of the order of 100 deg C at the nozzle outlet, although it attains 480 deg C in the reaction chamber.

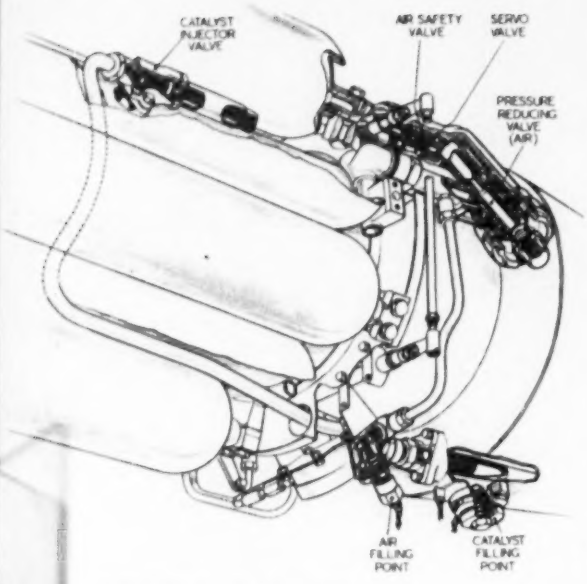
As such, the Sprite falls into the "cold" as opposed to the "hot" category of liquid-fuel rockets. These words "hot" and "cold" in this connection are colloquial terms which were coined purely for the sake of convenience by one of the major German rocket concerns, Walterwerke of Kiel. The difference between the hot and the cold rocket is, as may be supposed, essentially one of working temperature, but the matter does go somewhat deeper than this. A cold rocket is a simpler device than a hot rocket, in that it escapes the acute problems of heat transfer and fuel injection which bedevil the latter type. Payment for these advantages is, however, exacted in terms of performance, for the cold rocket has a fuel voracity roughly twice that of its hot complement. In finite terms, the hot rocket has a specific thrust of the 200 order, that is, it will give 200 lb thrust per lb of fuel consumed per second, whilst the cold rocket achieves a specific thrust of but 100 lb.

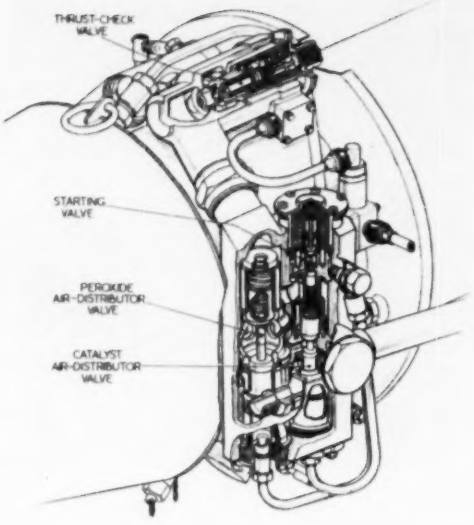
This thirst on the part of the cold rocket puts it out of court for anything other than very-short-term operation: practical considerations of tankage make it good for "endurances" measured in seconds, but for anything timed in minutes the claims of the hot rocket hold sway. However, for duties such as providing take-off assistance, the cold rocket offers an attractive solution, the more so in that its small bulk and simplicity are coupled with safety in operation.

Before going on to deal with the Sprite itself, the essential operational difference between hot and cold rockets might well be considered. In a hot rocket—of which the V-2 provides a classic example—propulsive thrust is derived from the combustion of fuel, for example, alcohol,

The Sprite is an entirely self contained propulsion unit, seven feet in length and 20 inches in diameter







Port (left) and starboard (above) views of valve units and control gear, showing relative dispositions and internal construction.

SPRITE ROCKET . . .

petrol or paraffin, in conjunction with an oxydizer such as hydrogen peroxide (although, in point of fact, liquid oxygen was used in the V-2). The function of the oxydizer is simply to provide a source of oxygen sufficient to support combustion, and in this connection the development of hydrogen peroxide at high concentrations was a valuable step toward making the liquid-fuel rocket a more practical proposition.

It is perhaps apposite here to remark on the curiously laggard-like attitude of our "military scientists" towards rockets in the past and, indeed, to some extent, in the present. Certainly, the German interest in rockets was common knowledge over here from as far back as the early twenties, and much as one might have detested the V-2 from actual experience of having lived in their target area, the fact that the weapon was a major scientific achievement must be recognized and our late enemies be given every credit for pursuing their unique researches to so terrifyingly efficient a conclusion. What is not generally known is that, ironically, highly concentrated hydrogen peroxide was developed in this country before the war (concurrently with, yet quite independently of, the similar German development), but when our authorities were apprized of it they exhibited a myopic lack of interest.

The Sprite owes its existence to the fact that de Havillands have always paid close attention to all developments which show any likelihood of attaining real significance in aviation. Thus it was that, in view of the German advances in the design of rocket propulsion, Major Halford set up a special-project section under the leadership of Mr. A. V. Cleaver, whose task was the evaluation of the various known forms of aircraft rocket and the development of units for manufacture by the de Havilland Engine Company. Initially, the special-project section concerned itself only with the most general study of the possibilities of rocket propulsion for aircraft based, in the first instance, on the extensive German data and experience. It soon became clear, however, that the hydrogen-peroxide cold rocket was simple and reliable and offered the most promising prospect for the evolution of comparatively simple units like the Sprite; it was, in addition, an essential stage in the wider programme of rocket research upon which the de Havilland Engine Company has embarked.

In a cold rocket, such as the Sprite, the oxydizer is itself the fuel and all that is required in addition to the concentrated peroxide is a catalyst. The chemical formula for hydrogen peroxide is H_2O_2, which is only another way of saying that each molecule of peroxide is made up of two atoms of hydrogen and two atoms of oxygen. A catalyst is simply a substance which, when brought into contact with the main substance (in this case the hydrogen peroxide) causes the latter to undergo a molecular change, or decompose. There are a number of catalysts for hydrogen peroxide; for example, among the metals platinum, silver and lead are extremely good, and copper is fairly active; mild steel, on the other hand, has a low catalytic efficiency, whilst stainless steel is almost inert and pure aluminium is 99.99 per cent inert. It is, of course, their catalytic reactive qualities as well as mechanical properties that have determined the materials used in the construction of the Sprite. In general, stainless steel has been used throughout, the only major disparities being the air bottles, which are of high-tensile steel, and the control valves, which employ duralumin bodies and ordinary steel internal components.

The catalyst used in the Sprite at the present time is either calcium permanganate or sodium permanganate at a concentration of 50 per cent by weight with water (the peroxide concentration is 80 per cent by weight with water). The function of the catalyst can conveniently be illustrated in the manner shown in the accompanying diagram. At A are shown two peroxide molecules, each composed of two hydrogen atoms and two oxygen atoms. When these molecules come into contact with the permanganate catalyst, the two hydrogen atoms and one of the oxygen atoms in each molecule break away to form molecules of water (as at B) whilst the spare oxygen atoms of the original peroxide molecules pair off to become a molecule of oxygen. Necessarily, this change of molecular state liberates energy and it is this energy in the form of heat that turns the molecules of water into steam. The heat generated is, however, greater than that required merely to turn the water molecules into steam and this excess is used to expand the molecules, with the result that they issue from the reaction chamber through the outlet nozzle as a high-velocity stream, the thrust being derived in accordance with momentum laws. The pressure generated in the reaction chamber of the Sprite is approximately 300 lb/sq in, and the temperature—as already noted—is of the order of 480 deg C, whilst the jet velocity is in the region of 3,500 ft/sec.

A good deal of misapprehension is current concerning the dangers and difficulties of handling hydrogen peroxide

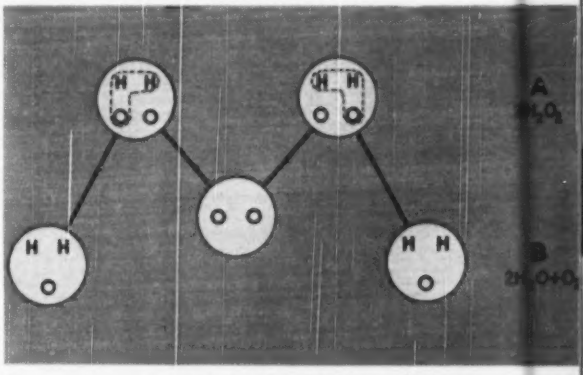
at high concentrations, but the considerable German experience and post-war knowledge in this country have established that the liquid can, in fact, be handled as freely as petrol if comparable care is exercised. The precautions required are different in character from those required for petrol but are of the same order of importance. Peroxide is perfectly safe so long as it is kept in clean, well-ventilated containers, preferably of stainless steel or aluminium. Contamination by foreign bodies will cause it to run down in strength, but except under extreme conditions, unlikely to be found in ordinary practice, the rate of strength-depreciation will not be great and no serious danger will result—always provided that the containers are properly ventilated. If spilt, hydrogen peroxide will decompose under the catalytic action of dirt, etc.; and in terms of fire risk, although the liquid is not itself combustible, if spilt, for example, on oily rags, it might possibly cause them to ignite. The whole question of safety in handling really devolves upon cleanliness, order and ventilation.

As a unit, the Sprite rocket motor consists of a stainless-steel cylindrical tank of 39 gallons capacity in which is stored the hydrogen peroxide; immediately abaft the tank is the reaction chamber, around which are axially grouped nine compressed-air bottles. The reaction chamber, which embodies a helical vane to promote mechanical mixing, discharges into the convergent/divergent propelling nozzle around the "waist" of which is fitted the 2½-gallon tank for the catalyst; the distributor valves, thrust-check and starting valves are grouped around the forward end of the catalyst tank immediately behind the ring manifold into which the air bottles discharge.

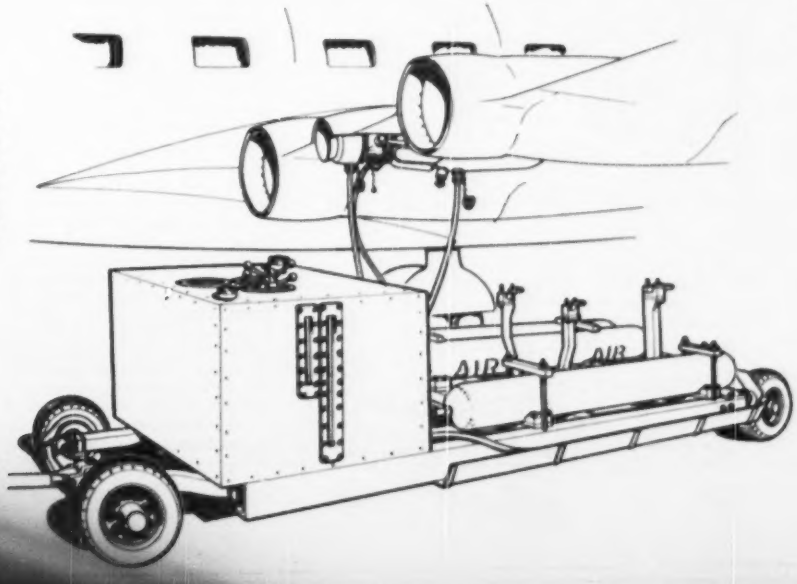
Delivery is controlled by the pilot through a mechanically operated on/off air-cock and by solenoid-operated air-distributor valves combined with an automatic pressure-reducing valve. It is the fact that these valves are operated by the pilot that enables him to carry out a check at 750 lb thrust in order to make sure that the unit is functioning correctly before the aircraft actually moves off. Furthermore, he is able to shut down the unit at any time during the reaction period. Each of these features provides safeguards which could not be obtained in rockets using solid propellants.

Air in the nine bottles is stored at a pressure of 3,000 lb/sq in, its purpose being to pressurize the peroxide and catalyst tanks in order to force the liquids into the reaction chamber. The air is released by the operation of three controls, viz., the air control, the selector switch and the firing button. The first of these brings the unit to readiness for starting, whilst the second serves to select whether the unit shall operate at reduced thrust for checking pur-

In this view forward into the propelling nozzle, the ends of the helical mixing vanes can just be discerned.



Diagrammatic representation of catalytic breakdown of hydrogen (A) into water plus oxygen (B).



To increase both convenience and safety, this special trolley has been designed for Sprite re-fuelling. All the filling operations—i.e., peroxide, catalyst and air—are controlled by selector valves mounted behind the control panel. Dissimilar connections are used to preclude mistakes.

SPRITE ROCKET . . .

poses or at full thrust for an actual take-off. In any event, no reaction takes place until the firing button is depressed.

From the ring manifold uniting the nine bottles, the high-pressure air (as shown on the schematic diagram) flows to the reducing valve, but until the controls are operated it is trapped and no pressure-reducing action takes place. When, however, firing is initiated, the high-pressure air flows through the reducing orifice (1) and, having reached the low-pressure side of the reducing valve, is then free to flow to the opposite end of the piston (2) through the central passage. The difference in area of each end of the piston causes it to be moved by the air load against the action of spring (3). This movement reduces the area of orifice (1), thereby reducing the pressure on the low-pressure side of the valve. Necessarily, as this pressure falls, so does that acting on the opposite end of the piston, with the result that spring (3) opens the orifice to increase the low pressure. Equilibrium is obtained when the delivery pressure from the reducing valve is approximately 500 lb/sq in, depending upon the input pressure.

On leaving the reducing valve, the air enters the safety valve. When the air control is "off," the shuttle valve (4) is opened by air pressure acting against spring (5), so allowing air to pass through the passages (6) to act upon the underside of piston (7). At the same time, this movement of the shuttle valve closes the vent passage (8). The head of piston (7) is therefore held closed against the shoulder (9) by air pressure and so prevents air from passing any farther through the system. When, however, the air control is moved to "on," the cam (10) increases the compression of spring (5) which, overcoming the air pressure, moves the shuttle valve to open (8) and close (6). Air in the volume beneath the piston (7) is therefore vented so that the air pressure acting on the top of the piston moves it away from the seating (9); the air can then pass to the rest of the system. In the event of the delivery pressure from the reducing valve rising above 600 lb/sq in, it will be enough to overcome even the increased spring-compression due to cam (10) being in the "on" position, so that the piston (7) will seat against shoulder (9) to prevent any excessive pressure from reaching the rest of the circuit.

The thrust-check valve, which is the next component in the circuit, serves only to provide a reduced air pressure in the propellant tanks, and therefore a reduced thrust output, solely for the purpose of checking the operation of the unit prior to take-off. The thrust-check valve is similar in action to the safety valve, with the difference that the shuttle is moved by a solenoid (11) instead of a cam and spring. The solenoid is energized by pressing the firing button, but *only provided* that "check" has been selected on the selector switch.

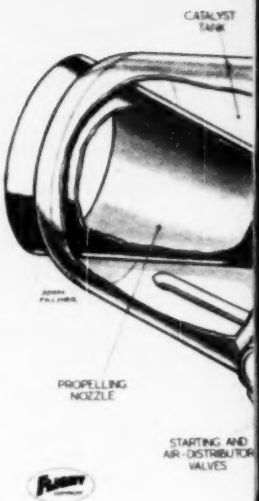
When the thrust-check valve is in operation, piston (12) is seated against shoulder (13) so that the air can pass only through the small-bore passage (14). This reduces the air pressure still further below the output of the reducing valve in order that the propellants are fed at a reduced rate and give only about 10 per cent of the normal thrust. When "fire" has been selected, however, the air can pass across the top of piston (12) and through the orifice seating (13)—as well as through (14)—that is, without such a further pressure drop.

On passing from the thrust-check valve, the air is delivered to the starting and distributor valves (which are, in fact, all in the same body) but, until the firing button is depressed, the air can get no farther. In this condition, the air is trapped above the shuttles (15), (16) and (17). Both the peroxide tank and the catalyst tank are therefore vented to atmosphere through passages (18) and (19), and (20) and (21).

When the firing button (22) is pressed, shuttle (23) (15)—operated by the solenoid in the starting valve—closes the vent (24) and opens the orifice at (25) so that air can flow through and thence along pipe (26) to the underside of piston (27) in the catalyst air distributor valve. Owing to the differential area design of the shuttle, the pressure below (27) overcomes that acting on (16) despite the additional downward load from spring (28). The shuttle therefore rises, closing off (19) and opening (29), so that air flows through into pipe (30) to enter the catalyst tank.

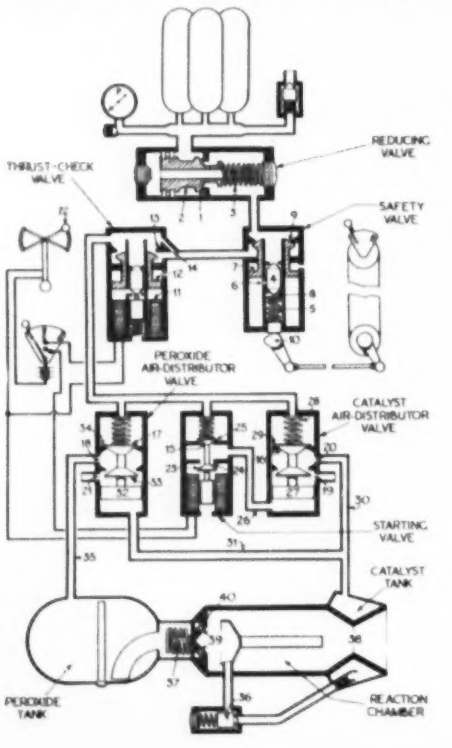
Until this sequence of events has occurred, the peroxide air-distributor valve cannot possibly operate and, therefore, the catalyst is always injected into the reaction chamber prior to the introduction of the peroxide. This is a safety feature in order to prevent the collection of excessive quantities of liquid peroxide in the chamber which could entail the risk of a dangerous pressure build-up were it all suddenly to be decomposed by the arrival of the catalyst. The design of the valve interconnection in the Sprite is such that, when air is flowing through pipe (30), it can also flow along pipe (31) to the underside of piston (32) in the peroxide air-distributor valve, in order to lift shuttle (17) (13) so that pressure air above the shuttle can flow through orifice (34) and proceed via passage (18) and pipe (35) to the peroxide tank.

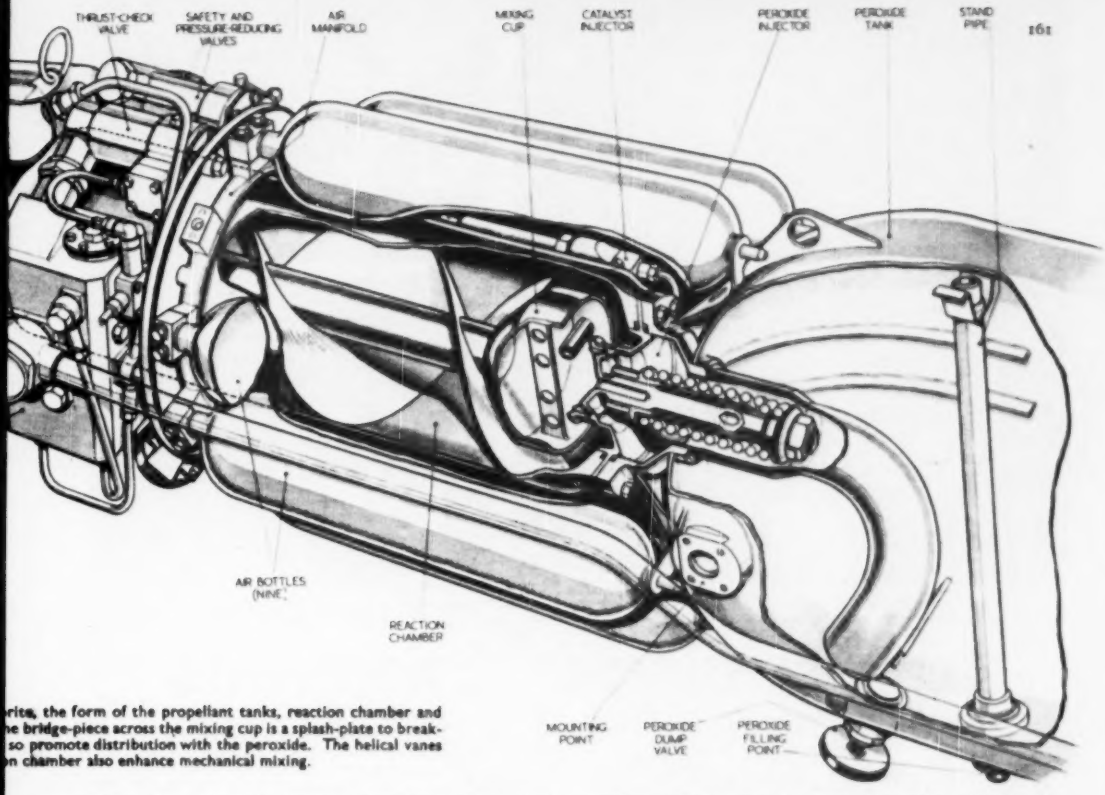
The air pressure in the propellant tanks thereupon builds up to values sufficient to open the spring-loaded non-return-type injectors (36) and (37), whereupon the pro-



In this introspective view of the exhaust nozzle are clearly shown down the catalyst into droplets in the rea

Schematic diagram of control-gear interconnection, annotated to show the operational sequence described in the accompanying text.





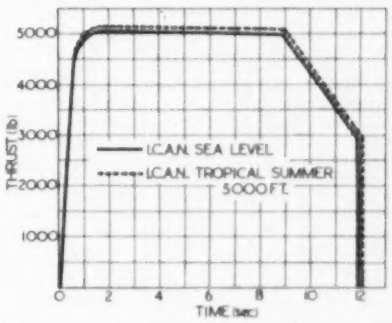
rite, the form of the propellant tanks, reaction chamber and he bridge-piece across the mixing cup is a splash-plate to break- so promote distribution with the peroxide. The helical vanes n chamber also enhance mechanical mixing.

pellants flow into the reaction chamber, where they spontaneously react and are exhausted through nozzle (38). As an aid to smooth starting, the poppet-valve-type peroxide injector is of two-stage design so that, initially, only a low-volume flow is admitted through the small ports (39). Subsequently, as the air pressure in the catalyst and peroxide tanks increases, the injector (37) opens progressively, so allowing the main flow of peroxide to enter the reaction chamber through the annulus (40) around the valve head. The normal pressure maxima are approximately 450 lb/sq in in the propellant tanks and 300 lb/sq in in the reaction chamber. In terms of performance, the total impulse of the Sprite is 55,000 lb-sec, the general characteristics being shown in the accompanying thrust/time curve, and in this connection, although the shape of the thrust "die-away" is arbitrarily shown as being from 5,000 lb at 9 sec to 3,000 lb at 12 sec, it is, in fact, capable of limited adjustment. It would also be possible to adjust the unit to give lower maximum thrusts for longer periods with only a slight loss in total impulse, e.g., 3,500 lb maximum thrust with a total time of about 16.5 sec, including thrust build-up and die-away.

Refuelling Trolley

In view of the fact that the fuelling of a unit such as the Sprite with two liquids and with compressed air could be a difficult, slow and (perhaps, in some circumstances) dangerous process, de Havillands have wisely designed a refuelling trolley which not only assists the avoidance of dangerous practices, but is, in addition, extremely convenient. All possible safety features are incorporated in the trolley design in order to ensure quick and tidy operation. Large compressed-air cylinders on the trailer are used to charge the Sprite air bottles by equalizing pressures, after which some of the remaining air is used to pressurize the peroxide and permanganate service tanks—which are of the correct capacity—on the trailer. This displaces the fluids from the service tanks up into the appropriate tanks in the Sprite through hoses terminating in self-sealing couplings, which latter are purposely made of different sizes so as to eliminate the possibility of incorrect connection. All the filling operations are controlled by selector valves mounted behind the control panel on the trailer. A drawing of the trolley appears on page 159.

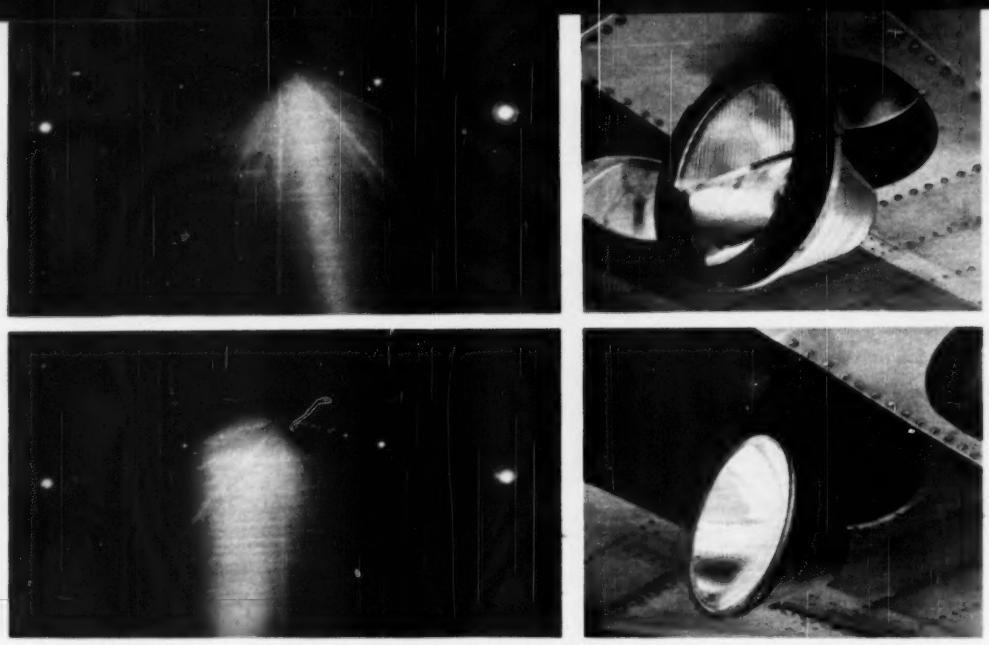
C. B. B-W.



Idealized curve of thrust development plotted against time.

D.H. SPRITE DATA

Length	84in
Maximum diameter	20in
Weight empty	350 lb
Weight charged	925 lb
Fuel capacity (hydrogen-peroxide)	39 gall
(catalyst)	2.5 gall
Performance	
Total impulse	55,000 lb-sec
Maximum thrust	5,000 lb
Check thrust	750 lb
Thrust die-away	5,000 lb at 9 sec 3,000 lb at 12 sec
Temperatures and Pressures	
Tank pressure (firing)	450 lb/sq in
Reaction-chamber pressure	300 lb/sq in
Reaction-chamber temperature	480 deg C.
Jet-efflux temperature	100 deg C.



The superiority of the diffuse beam of the Harley lamp (upper views) over the hard beam of the R.A.E. "K" type unit can be clearly seen in these photographs, which were obtained during the comparative trials conducted by British Overseas Airways Corporation.

FOR "LIGHTER" LANDINGS

Recent Developments in Landing-lamp Design : The Harley Range

THAT some pilots, particularly those of the older school, consider the aircraft landing-light to be more of a nuisance than an asset almost certainly arises from the fact that they have never had the opportunity of landing with a really efficient lamp. The question then arises, "What are the essential qualities of a really efficient landing-light?" A consensus of pilots' views would show that the ground ahead should be brightly illuminated for as great a distance as possible in all directions; and that at the same time the beam itself should not be so "harsh" as to distract the eyes and prohibit retention of a wide field of vision. In fact, it might be said that the essence of a good landing lamp is that a pilot should be able to see by its illumination in spite of its beam. To this end the firm of Harley Aircraft Landing Lamps has devoted considerable research over recent years and has evolved a principle which appears to be giving very satisfactory results.

In the Harley lamp the user has an extraordinarily powerful light for a relatively small current consumption, distance-intensity being combined with good local illumination of wide spread and depth. These lamps differ noticeably from other types in the addition of a fluted lens fitted behind the upper half of the glass. The object is to project and diffuse the beam from the upper half of the reflector down through the beam from the bottom half, thus giving a graduated area of light while retaining distance-intensity and eliminating the effect (normally experienced with high-power conical-beam lamps) of a hard, glaring beam with a sharply defined cut-off at its edge.

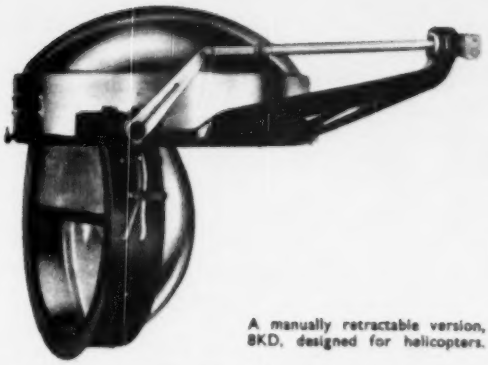
A recent comparative demonstration of lamps of varying size and power, all using the Harley principle, showed convincingly its distinct superiority over a unit (in this case a standard R.A.E. "K" type lamp) employing the hard-beam principle. Even with the lamp elevated to give its extreme range—dependent, of course, on the power of the unit in question—a wide span of diffused light, in which objects could be clearly distinguished, extended to either side of the almost invisible beam. The "K" type of lamp, however, gave its intense illumination over a more restricted area surrounded by an impression of complete blackness in which it was impossible to recognise even comparatively large objects. Incidentally, it may be remarked that certain American lamps, mostly developed on the "sealed-beam" principle, go some way towards eliminating the more undesirable qualities of a hard beam.

A double-filament arrangement can be supplied at option on most of the Harley lamps. In this case independent switching enables the secondary filament—normally rated at a lower wattage than the primary—to be used for taxying purposes. The life of the main filament is thus lengthened and the load on the battery reduced at a time when the generator is not giving its full output.

Comparative tests have been carried out by the B.O.A.C. development flight at Hurn, using a Lancaster aircraft, and results of these tests were based on a series of twelve night landings and take-offs. The lamps in question were a Harley model 19KS-500 with a single-filament 500-watt bulb and, for comparison, a standard R.A.E. modified "K" type, fitted adjacent to the Harley lamp.

Extracts from the reports indicate the pilots' definite preference for the Harley system: "With the Harley lamp in its fully extended position, on the descent it was quite easy to look down through the beam and see the approach

The Harley model 9K as fitted to the Viscount and Comet.



A manually retractable version, 8KD, designed for helicopters.

FOR "LIGHTER" LANDINGS . .

path, whereas with the 'K' lamp the beam was too harsh for objects on the other side of it to be clearly observed, and the runway lights beyond the beam were completely cut off. With the Harley lamp fully extended landing was pleasant and easy. The illuminated area increased gradually in size on the descent and height above the flare-path could be judged without distraction caused by the beam.

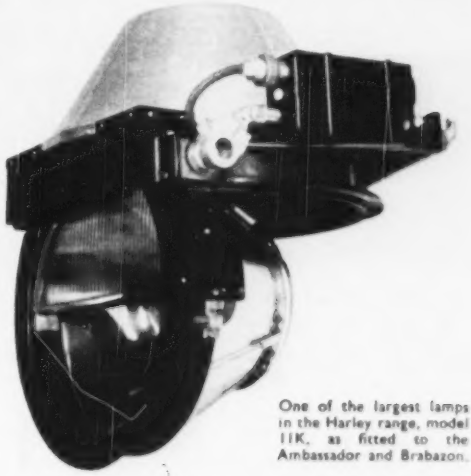
"With the 'K' lamp," continues this particular report, "the patch of brilliant light became harder and brighter as height decreased and height above the flare-path could not be judged so effectively. Although neither light had sufficient depth of beam to cater for both tail-down and tail-up attitudes, and consequently adjustment by means of the 'inching' control fitted in each lamp actuator circuit was necessary, the greater depth of the Harley compensated to a large extent for a change of fore-and-aft attitude on the approach. The Harley lamp in its fully extended position illuminated objects on the ground from about 400ft and at 200ft the view of the ground was quite good. The 'K' lamp, depressed to 80 degrees, also illuminated objects at 400ft, but at 200ft gave a spot which, although well lit, had a harsh, black surround."

Some idea of the graduated spread and diffusion in comparison with the harsh, impenetrable beam of the "K" type can be obtained from two photographs in the heading. The runway lights are 100yd apart and the height of the lamps above the runway is 30ft. One pilot reported: "At 400ft, the aerodrome was seen as in daylight. When the aircraft was just about to touch down, light extended the whole length of the flare-path (800yd). When coming in over the boundary at 100 to 150ft the area illuminated was from a point just below the aircraft to a point about 500yd up the flare-path, which on the night of the test was about 300yd up-wind from the boundary."

There are over 30 different types of landing lamps in the Harley range, each made for a specific purpose. Models are available from 6 to 14 inches in diameter and from 144 to 1,000 watts in power. Versions are available for fitting in nose-fairings, in leading edges and on the undersurfaces of wings. For wing installations there are both electrically and mechanically retractable types ranging from 6 to 11 inches in diameter and up to 750 watts in power. Speed of retraction even on the largest models was an impressive feature of a demonstration witnessed by a member of the staff of *Flight*. Models have also been designed for helicopters and light aircraft.

Among other developments by the same firm are taxying lamps, which provide a circular pool of light around the aircraft, the upper limit of the beam being horizontal and the diameter of illumination approximately 400yd.

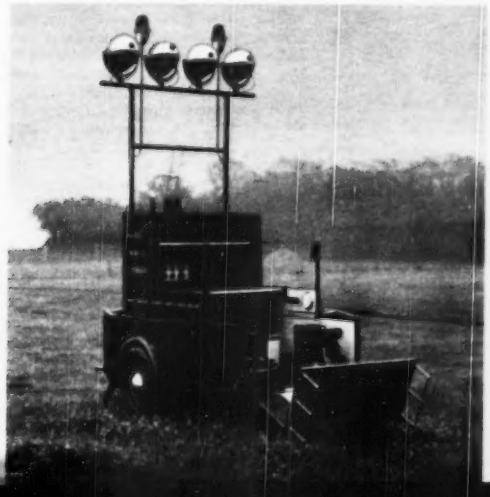
Harley portable floodlights, with self-contained generators, suitable for use on emergency or small airfields, give adequate illumination for landing. Fitted with red indicator-beacons, they obviate the necessity for boundary lighting, illuminated wind-indicators and mains-power floodlights. During the demonstration to which reference has been made, one model—the well-designed and robustly constructed F.D.T. trailer unit shown below—illuminated a ground area of adequate width and up to 1,000yd in length, at which distance it was still possible to read a newspaper with ease. This floodlight undoubtedly provides lighting conditions in which the pilot of any aircraft in the medium-twin category would not hesitate to land.



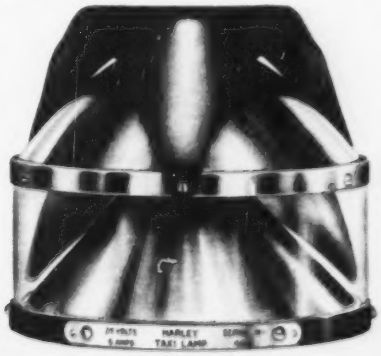
One of the largest lamps in the Harley range, model 11K, as fitted to the Ambassador and Brabazon.

Because development in one field often results in progress in others, it is not out of place to observe that the activities of the firm's workshops are by no means restricted to aviation, Harley lighting units being adaptable to a multitude of transport and industrial uses.

This view of the FDT mobile floodlight emphasizes the ease of access to generators and floodlights.



The 144-watt 6V5 taxying and manoeuvring lamp, fitted in either retractable or static form.



BRITISH GUIANA'S AIRLINE

Official Encouragement for a Service that is Opening-up the Colony's Hinterland

By J. R. SINGH*

Maj. A. J. Williams, O.B.E., pioneered many of the routes. With the author, he organized an expedition into the Rupununi savannahs (see map).

Air routes extend beyond the reach of road and rail.

AIR transport will play an increasingly important part in the development of the economic possibilities of British Guiana's 78,700 square miles of hinterland. Successful prosecution of schemes embracing planned settlement of some 100,000 surplus British West Indian population and European displaced persons in the interior of the Colony within the next ten years will depend largely on air transport in at least the initial stages. Foreseeing such an eventuality, a former Governor, Sir Gordon Lethem, succeeded during his term of office in inducing the Colony's Government to take an active financial interest in the expansion of British Guiana Airways, a privately owned subsidized internal air service which to-day operates a fleet of six aircraft, comprising two Dakotas, three Grummans, and a Wasp-engined Ireland. [A pre-war American make, not very widely known.—ED., *Flight*.]

Begun in 1934 by Mr. (now Major) Arthur James Williams, an American who owns the controlling interest in the company, the development of air transportation in British Guiana has been rather spectacular. Indeed, the advent of internal air transport has been a primary factor in the unprecedented large-scale mining expansion and other developments over the Colony's sprawling hinterland, extending from Baramita in the North-West District to the headwaters of the Essequibo River in the South Rupununi district.

At first the British Guiana Government were disinclined to grant Mr. Williams a licence to operate an air service in the Colony, mainly because earlier attempts to inaugurate such a service had proved failures. But the British Guiana-Brazil Boundary Commission was so greatly helped by Mr. Williams' service that early in 1938 the Government appointed a committee to explore the possibilities of ensuring an air service for the Colony, and as a result Mr. A. J. Williams and his business associate, Mr. J. H. Hunter, a British subject resident in New York, were authorized to operate an internal service.

The terms of the contract provided only for charter flights, and it was not until June, 1944, that the first regular passenger-mail-freight service was put into operation, with fortnightly runs to the Mazaruni district, and monthly runs to the Rupununi savannahs. Since then, British Guiana Airways have been able to develop an almost indispensable service, providing rapid, reliable and convenient means of transport to the various remote and hitherto inaccessible riverain areas of the Colony. It was not until the closing stages of the war that active steps were taken to establish airstrips for civil purposes in the interior of the Colony. This was facilitated by grants totalling £25,500, made available under the

* *In an article in the December issue of "The Crown Colonist."*

Water strip: A Grumman Goose takes off from Baramita Pool, 2,500ft long by 150ft wide.

Progress

The Derwent Meteor Trainer as supplied to Belgium, Holland and Luxembourg is powered by

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VOTE FOR . . .

Now let's be terribly terribly careful. This announcement is *not* political. We bow and raise our hats to *all* politicians —Snoopers, Droopers, Filthy Reactionaries, Little Hitlers, Blimps and even Welsh Gizzards, whether of the Left or Right. We have nothing printed on our bags except the name of a firm of multiple tailors. All we want to say—in a most unpolitical tone of voice — is that in our opinion all these speeches and articles about Productivity don't amount to as much as a day's output of Desoutter Power Tools in increasing production per worker. And in our very, very, very humble opinion that is what most of the people we know are interested in; and not in the production of noise, heat and hot air — at which Desoutter Tools are no good at all. Have we said something we shouldn't?

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BRITISH GUIANA'S AIRLINE . . :

Colonial Development and Welfare Act. In August, 1946, with the completion of a number of airstrips capable of accommodating suitable freight-carrying aircraft, plans were pushed ahead by the Governor, Sir Gordon Lethem, for the further expansion of the internal air service. In despatching Major Williams to the U.S.A. to purchase two Dakotas, Sir Gordon gave particular attention to the proposal for air transport of beef from cattle ranches in the Rupununi to Georgetown. These proposals have since been implemented and have gone a long way towards relieving Georgetown of its periodic beef shortages. Mr. B. C. H. Cross, Air Transport Adviser to the Colonial Office, expressed the opinion that the Colony presented an ideal testing ground for the future of cargo-carrying aircraft in the Empire, and that it seemed very likely that here for the first time in the Colonial Empire "roads may follow the air."

To-day there are more than 40 airstrips in various parts of the Colony's hinterland, including a water landing pool at Baramita, in the North-West District. And at least eleven major American, Canadian and British companies and numerous smaller enterprises and individuals are enabled to carry on mining operations in the remotest parts of the interior, thus bringing in much-needed dollars. Jeeps, five-ton trucks, tractors with trailers, and sawmilling equipment have been flown by Dakotas into the interior. Early last year an air compressor weighing 6,000 lb—the payload capacity of a Dakota—was flown in one unit to the Potaro district for Anaconda Guiana Mines, Ltd. Tractors of 40 h.p. have been flown to the Rupununi and driven off the aircraft under their own power.

These developments in aviation have had a most favourable reaction on the Colony's economy in that they have provided the necessary impetus for (*a*) the expansion of existing and the development of new interior industries, and, as a corollary, the creation of new labour outlets; and (*b*) the penetration of the economic possibilities of the vast hinterland, described by Sir Gordon Lethem as a "store-house of riches." British Guiana Airways to-day is experiencing a virtual traffic boom. Passengers and freight hauled to and from the interior during the company's financial year ended September, 1948, reached a record level, with passengers numbering 4,370 and freight totalling 1,216,948 lb, as compared with 2,308 passengers and 1,099,166 lb for the previous peak year. The upswing in the airline's payload traffic was due primarily to the introduction of low passenger-freight schedules brought into effect on April 14, 1948.

With the introduction of the new rates, charter flights took a downward trend but without affecting the volume of traffic hauled. Mining companies in particular found the revised schedules beneficial, and the majority have taken advantage of the weekly mail service to transport their cargo and men, whereas formerly they depended on the comparatively costly charter flights.

With the expansion in internal air transport the Government appointed a Controller of Civil Aviation for the Colony. He is an ex-R.F.C. officer, Maj. Jack Nicole, formerly a senior officer in the British Guiana Police Force, and he functions under the direction of the Director of Civil Aviation in the West Indies, W/C. L. Egglesfield. This appointment is another forward step in the establishment of an internal self-contained air service in the Colony on a sound permanent footing. And Maj. Nicole's knowledge of the problems and his appreciation of the difficulties in operating a bush air service augur well for any new planned developments. In the meantime, Maj. Williams is weighing the possibilities of expanding his fleet by the addition of 12,000 lb-capacity Bristol Freighters, in anticipation of an even greater demand on his service.

FRENCH-BUILT VAMPIRES

LAST Friday, January 27th, the first French-built Vampire—constructed by the S.N.C.A. Sud-Est at Marseilles—flew from Marignan. This is the first machine of a production order of undisclosed size and it is remarkable that it should, in fact, have flown within less than a year: the agreement was signed only last March. The Vampire is Goblin-powered and was flown by a French pilot.

LIGHT AIRCRAFT RADIO

SOME further information of interest to potential users of light-aircraft radio has become available since publication of an article on the subject in *Flight* of January 19th.

The equipment made by Aeronautical Radio Services, Ltd., now consists basically of a 24-channel (not 11-channel) V.H.F. transmitter-receiver. The following services are available in a single unit: 24-channel V.H.F. transmitter and receiver; M.F. D/F, receiver, incorporating homing, omni and speech; 38 and 75 mc/s marker receivers; S.B.A. tunable beacon receiver; and intercommunication.

In connection with the combined equipment made by the Romac Radio Corporation, it should be added that these installations were developed by the Nav-Rad Research Co., and are manufactured by Romac under licence.

BELFAST REDUNDANCIES

AN assurance of every possible Government aid to maintain the employment level at Short Brothers and Harland, Ltd., Belfast, was given to a deputation from the company by the Minister of Supply, in London, on January 25th.

The deputation, consisting of members of the works' Joint Production Consultative and Advisory Committee, expressed concern at the number of redundancies caused by the falling-off of orders from the Ministry. Some 650 employees had already been dispensed with, and the company could not assure the workers that that was the end. The deputation asked the Minister for more work which would make the reinstatement of the discharged workers possible, and for a development of the aircraft industry in Ulster to make it self-supporting in all branches of design and production.

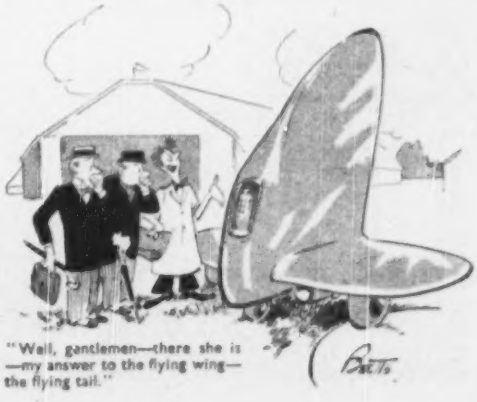
In reply to the representative, Mr. Strauss said that no final conclusions has been reached on Shorts' programme. While he could give no specific undertaking, he gave an assurance that he was approaching the problem with a strong desire to help in every way.

"The Ministry is anxious to do whatever it can to ensure as much work as possible for Short and Harland," he said. "It is a first-class firm in which the government is taking a close interest, because of the special considerations arising out of the transfer from Rochester."

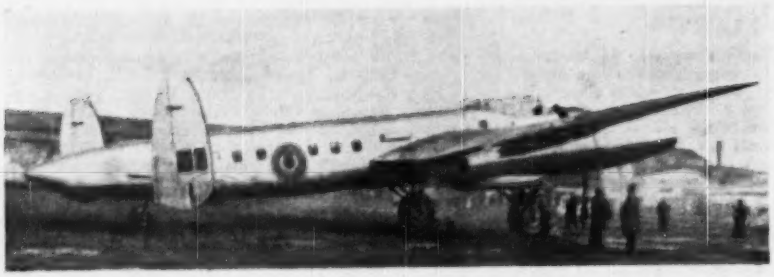
MOUNTAIN RESCUE TEAM

CADETS of a South-East Lancashire A.T.C. Squadron—No. 1855 (Royton)—have added to their reputation by becoming the first squadron to have their own motorized mountain rescue team. Supervised by their Commanding Officer, S/L. Robert Kenworthy, the scheme has proved a success owing to the enthusiasm of the cadets themselves.

Of the unit's strength of 130 cadets, 15 of them have been chosen for the rescue team, the average age being 17. The team was recently called out to scour the moors above Oldham for a missing R.A.F. Mosquito, and also on the occasion of the B.E.A. Dakota crash at Greenfield. It is hoped that in the near future the squadron may gain official recognition as a sub-unit of a regular R.A.F. Mountain Rescue Team.



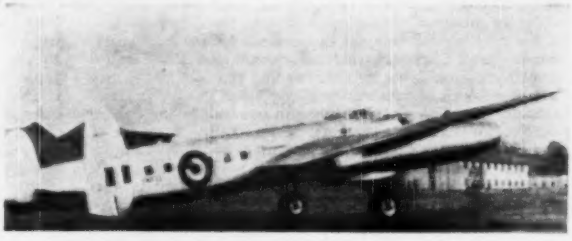
"Well, gentlemen—there she is—my answer to the flying wing—the flying tail."



Comparative test-bed installations of the latest British turbojets, the Rolls-Royce Avon (left) and the Armstrong Siddeley Sapphire (below). Both are advanced axial designs capable of giving greater thrust than any other existing unit of their type. The small photograph (lower left) shows the earlier D.H. Ghost installation—a shorter, centrifugal turbojet of 5,000 lb. thrust.

TURBOJET TEST-BEDS

Lancastrians Continue to Aid in the Flight Development of Turbine Power Units : The Sapphire Flies to Boscombe

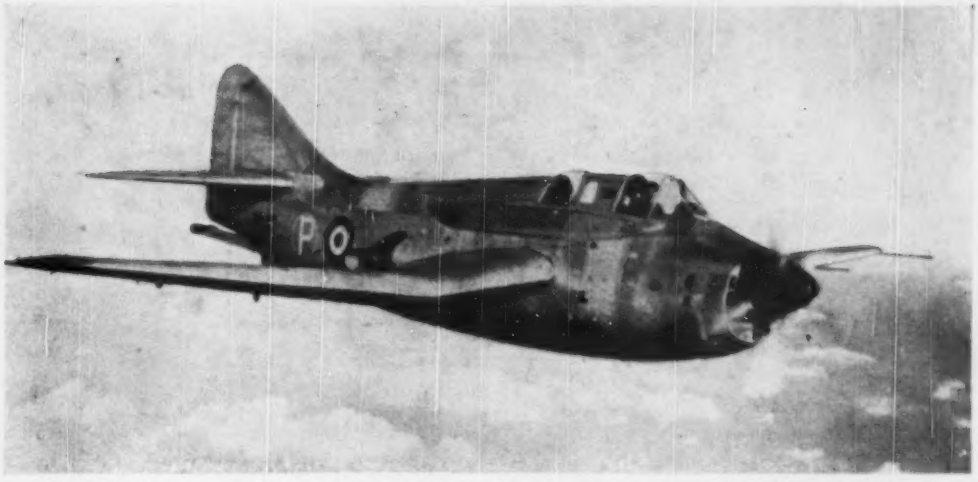


WHEN aircraft gas turbines were still uncommon, and only a few privileged test and fighter pilots had flown by jet power, the first appearance of a four-engine gas-turbine "flying test-bed" was something of an occasion, and one of wide interest. Many people had their first experience of smooth, silent, pure-jet flight in the Nene-Lancastrian with its inboard Merlins feathered. To-day, when dozens of different types of turbine-powered aircraft, both military and civil, are flying in this country every day, one more Lancastrian test-bed with a pair of new turbojets in the outboard positions can take to the air unnoticed, although keen interest may centre upon the announcement of the first flight of the turbine unit concerned.

Last week we reported the delivery, from Air Service Training at Hamble to the A. and A.E.E. at Boscombe Down, of a Lancastrian test-bed with two Armstrong Siddeley Sapphires in the outboard nacelles. These powerful new axial turbojets (known during earlier development as Metrovick F.9s) are a most important addition to the country's list of military power units. With the Sapphire, Avon and Canadian Avro Orenda well advanced in development—performance and details of all these engines are restricted—availability of turbojets in the over-6,000-lb thrust class (without afterburning or other thrust augmentation) for new military aircraft designs is ensured. A rating for one of these axial units has been released, namely, 6,000 lb thrust for an early mark of Avon.

These close-ups studies of the Sapphire and Avon nacelles in Lancastrians VM733 and VM732 indicate a close similarity in outline and dimensions of the two axial turbojets enclosed.

FOR FINDING, FIXING, STRIKING



Flying for its first air-to-air portrait is the Fairey 17 carrier-borne anti-submarine aircraft, powered by an Armstrong Siddeley Double Mamba turboprop and equipped to employ the latest techniques in seeking out and destroying under-water craft.

MORE ABOUT THE TAY

ALTHOUGH the various odd scraps of information which have been forthcoming about the Rolls-Royce Tay turbo-jet can be combined to give a fairly complete if somewhat superficial picture of the unit, only one official release has so far been made: last week, when the Ministry of Supply gave the power figure for sea-level static thrust as 6,250 lb. This power figure relates to the R.Ta.1.

In the main, details of the Tay have come from America, where the Pratt and Whitney company, which holds the licence to build the Nene—or JT-6B Turbo-Wasp (Navy J-42) as it is called—also intends to produce the Tay, for which the Navy designation is J-48.

Pratt and Whitney have co-operated with Rolls-Royce in the development of the Tay, which has been described as a Nene derivative, more powerful and lighter as a result of using magnesium in place of aluminium alloys. It was learned recently that the Pratt and Whitney Tay will be equipped with after-burning and installed in the Lockheed F-94B all-weather fighter, of which, it seems, the U.S. Air Force are to have ten this year. The maximum thrust will be 8,000 lb.

Another announcement is the figure of 5,500 lb sea-level static thrust for the latest Rolls-Royce Nene, the R.N.3.

EXPORT TARGET FIGURE EXCEEDED

PUBLICATION of British aircraft export figures for December, 1949, shows that, as was expected, the target figure of £33 million for the year was handsomely exceeded—actually the £34 million mark was passed.

Since the war ended, the industry has sent over £100 million worth of airframes, engines and accessories abroad.

The December figures, in detail, were as follows:—

	£
65 complete aircraft	1,536,536
126 engines	398,702
1,874 rubber tyres	18,855
Other items	932,354
Total	£2,886,527

QUARTERLY TOTALS

Quarter	1947	1948	1949
	£	£	£
1st	3,748,036	7,115,729	9,377,091
2nd	5,950,422	6,568,138	6,459,596
3rd	7,704,089	5,766,315	10,223,492
4th	7,377,881	5,608,525	8,154,998
Totals	£24,750,428	£25,058,707	£34,215,177

Approximately two-thirds of the 1949 total of £34 million, says the S.B.A.C., were exported on direct orders secured from overseas buyers, the balance being from sales effected between the British and foreign governments. Transfer-sales from government to government have now passed their peak, an off-setting factor being the manufacture of British types abroad.

The imports-against-exports picture is not so satisfactory, imports of aircraft, accessories and shares having increased markedly in the last four years, as the following figures show. Dollar imports, of course, were largely responsible for the deficiency.

Year	Exports	Imports	Excess of Exports	Percentage of Imports to Exports
	£	£	£	Per cent
1946	14,563,419	1,145,396	13,418,023	8
1947	25,055,200	3,762,549	21,292,651	15
1948	26,004,784	7,102,207	18,902,577	27
1949	34,215,177	17,362,413	16,852,764	50

PARTY: Members of the International Air Transport Association attended a party at Grosvenor House, London, given last Friday by the Plessey Co., Ltd. Among those present were, left to right: Capt. Hunt (M.C.A.), Capt. J. G. W. "Jimmy" James (B.E.A.), A.V-M. Sir Victor H. Tait (B.O.A.C. and International Aeradio), and Capt. A. P. W. Cane (B.O.A.C.). In the absence of Mr. Alan Clark (Plessey managing director), through illness, Mr. John Clark deputised.

AMERICAN NOTEBOOK

By

Stanley H. Evans

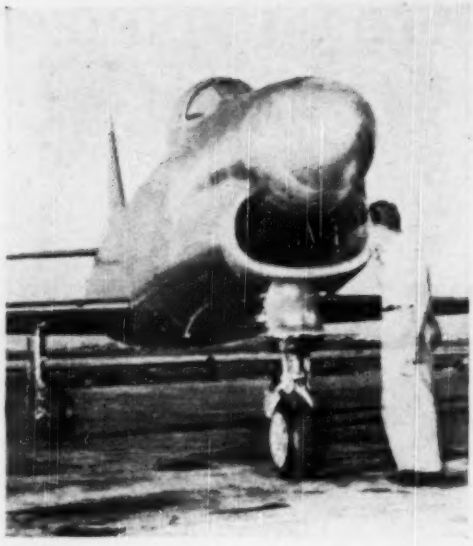
F.R.Ae.S., A.F.I.Ae.S.

PROBATIONARY PROBOSCIS

UNLIKE the elephant, which seemingly remains self-satisfied with its antediluvian suctorial organ, the gas turbine has not yet settled down to the dull conformity of a standardized breathing apparatus. As might have been expected from radial-engine cowling practice, the nose type of air intake (seen in the original Gloster-Whittle design) led the fashion parade. Current turbojet installations, however, show a wide variety of aspiration systems, being adapted to breathe through the nose, mouth, ears, belly, dorsal, or reversed piscatorial gills of the fuselage anatomy; or through various forms of leading-edge scoop in the wing. Whether to ascribe this to the versatile touch of genius or the changing whims of the aero-thermodynamicist may be a nice point, but beneath the surface lies the more prosaic (but vitally important) sphere of the equipment designer struggling to shoe-horn all the military essentials into a very tight-fitting shoe.

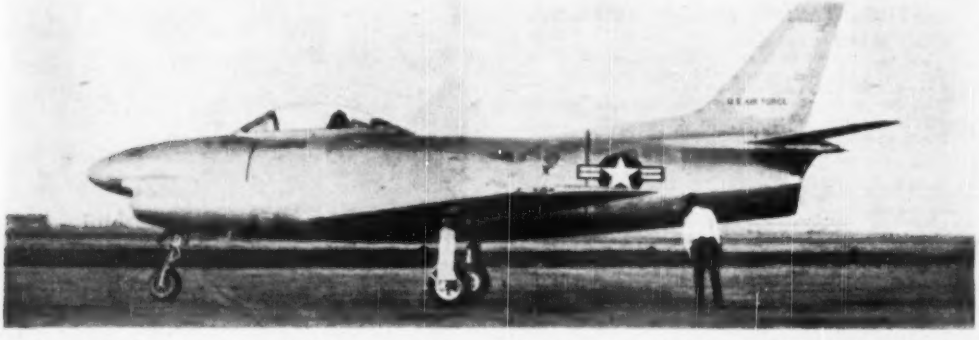
And of all the essential military equipment that has to be compressed into the smallest possible fringe of airframe, the armament group rates top priority and cannot be subordinated to any other design requirement—not even optimum aerodynamic performance. The classic doctrine that a fighter aircraft is only as good as its offensive armament has been proved in two wars and is likely to remain a truism, since the prime reason for putting a fighter into the air is, obviously, to bring its ballistic punch into action on a target. But the modern jet fighter is now learning to probe with radar, and so to the ballistic side of the business has been added the trickery of electronics for sighting and even gunlaying on the target.

Because, therefore, armament and radar must function hand-in-glove, considerable research and design development has been directed towards improved engine aspiration systems which leave the nose extremity of the fuselage available for the installation of a radar scanner and ancillary equipment. Thus, in our recent review of the Douglas Skyrocket (*Flight*, January 5th, 1950), we have drawn attention to the submerged, flush-type inlet scoop now coming into vogue in the U.S.A., but an interesting application of what can be done as an interim or probationary measure to an existing nose-type intake, to adapt it for modern radar requirements, may be seen in the North American YF-86D, now under flight test at Muroc.

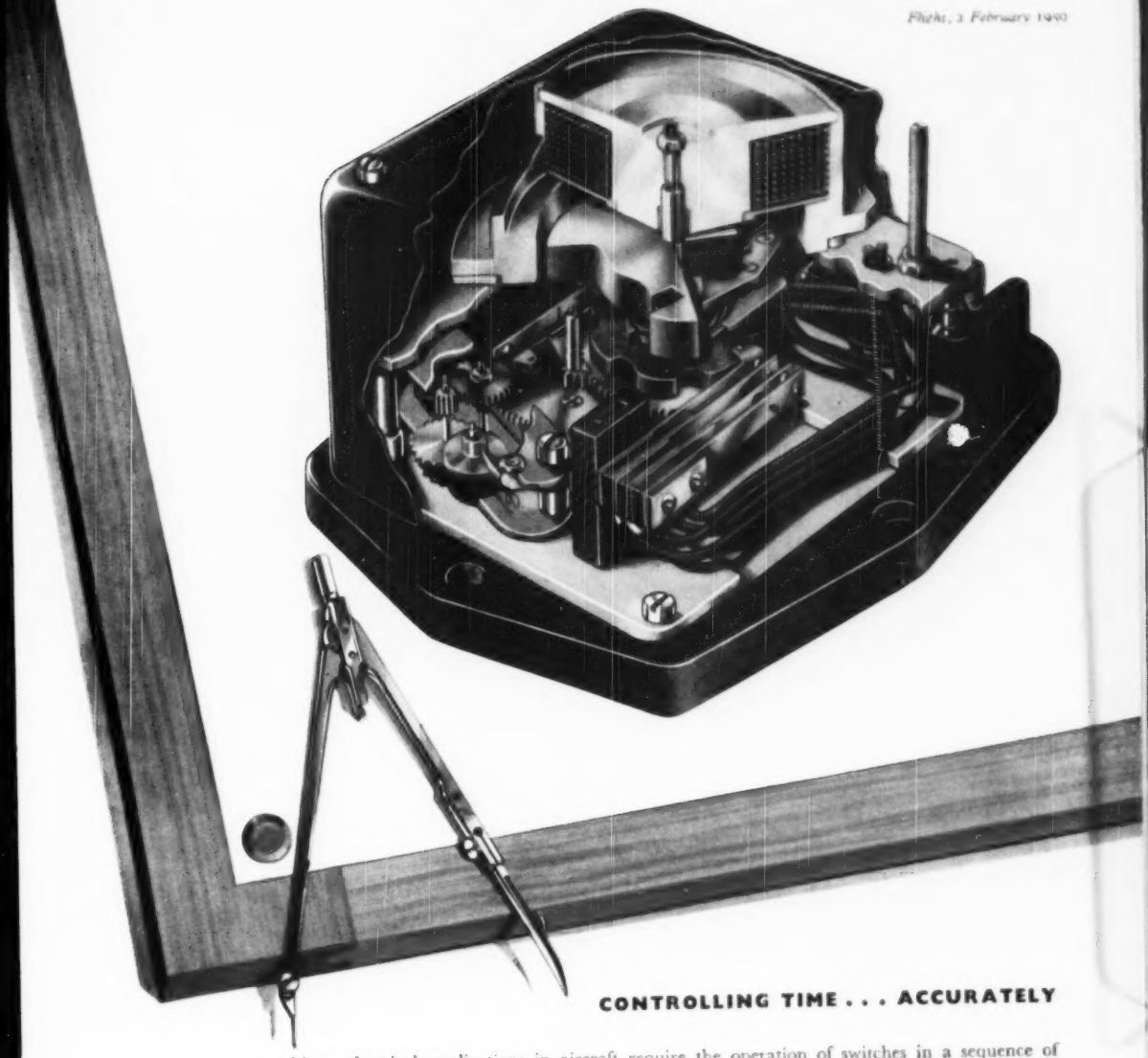


"... the YF-86D differs from the rest of the family line in breathing through the mouth instead of the nose ... what might have been a proboscidean dead-end or cul-de-sac has been warded off."

To appreciate the design background of the YF-86D, a note on the aspiration system of the standard F-86A Sabre is relevant. It features a single, straight-through ram duct with nose entry, patterned like its naval cousin and predecessor, the FJ-1 Fury shipboard fighter, on earlier N.A.C.A. research; at the time the F-86A was on the board in 1944-45, this arrangement was considered the most efficient aero-thermodynamic combination. The Republic F-84 also falls in much the same category, except that the duct is bifurcated to clear the pilot and controls. Lockheed, on the other hand, have always avoided the nasal accent, preferring to inhale through the ears, as it were. From which it should not be inferred that our Lockheed friends were more prescient than the rest (at any rate, in



The North American YF-86D is a second edition of the well-known F-86A Sabre and has been designed as a high-altitude interceptor fighter. Noticeable changes from the first edition are the mouth-type air intake and nose radome, together with the addition of an afterburner to the General Electric I-47 turbojet unit.



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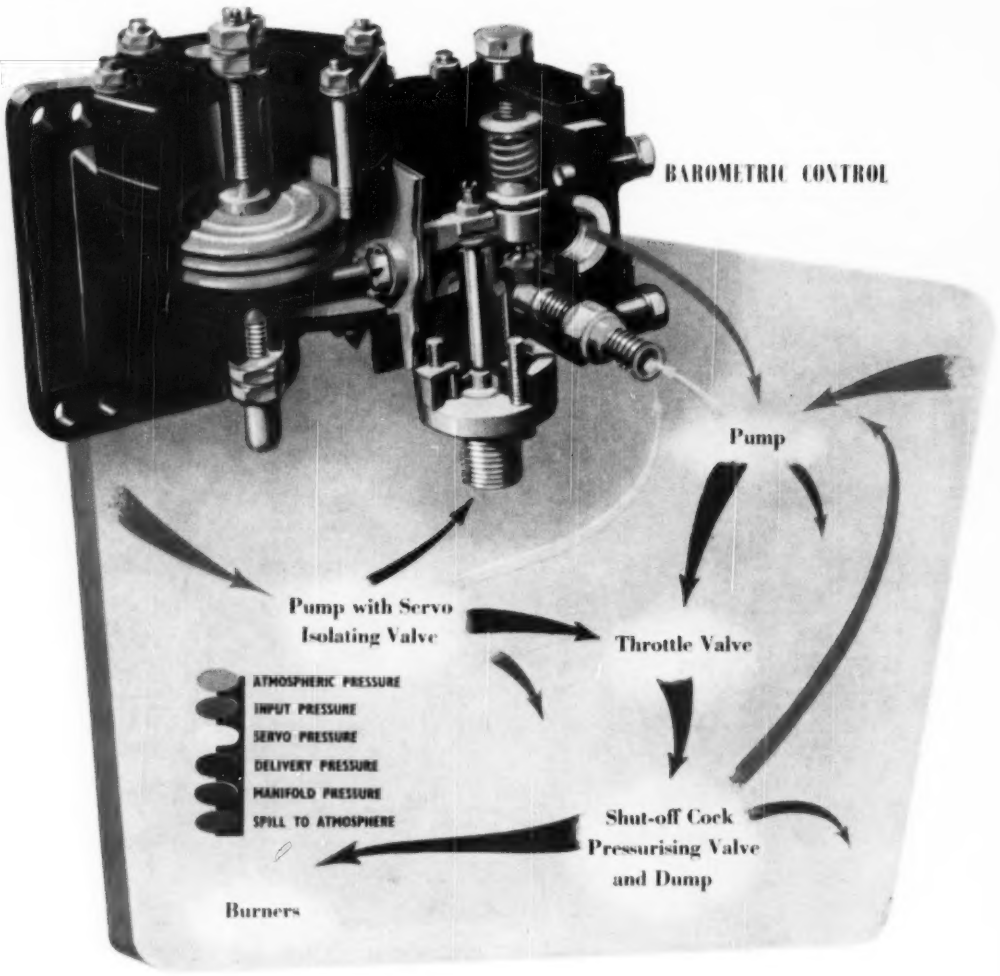

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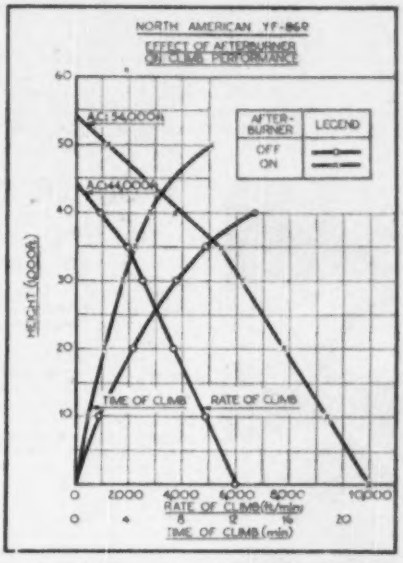
this particular feature): at the time at which all these earlier jets were laid out, the radar requirements as we know them to-day were below the military horizon.

Designed as an all-weather, high-altitude, interceptor variant of the F-86A, the YF-86D differs from the rest of the family line in breathing through the mouth instead of the nose, in order to house a nose radar installation. The shark-like, mouth-type air intake is fashioned neatly under the nose radome, just forward of the nose-wheel leg; in other words, the standard F-86A nose inlet has been lowered about a foot or so, to make room for the radar scanning equipment above it. These new facial characteristics enhance the appearance, we think, of the fuselage nose lines, although whether the external airflow is thereby improved can only be answered by flight performance analysis. It seems safe to say, however, that the internal aerodynamics are little changed, as the high ram-pressure effect of the nose-entry type should be well maintained. And so, by this face-lifting process, what might have been a proboscidean dead-end or cul-de-sac has been warded off.

Which is not to say that the North American design team have been resting on their prestige or their pencils, for the signs indicate that the YF-86D is more in the nature of an interim model leading up to a still later variant of the F-86A. This is the XF-93—formerly designated the F-86C—which is now reported on the Muroc test-line. The forthcoming début of the XF-93 will show that North American have joined the current fashion parade by adopting the submerged side-inlet type of air-scoop let into the fuselage skin, similar in fact to that seen in the Douglas Skyrocket and a recent experimental version of the Republic F-84. (The latter was illustrated in *Flight* of July 21st, 1949.) North American Aviation have 122 YF-86Ds and two XF-93 prototypes currently on order.

The rear fuselage section of the YF-86D is also different from that of the F-86A, being enlarged to accommodate an afterburner installation. Power-plant is a General Electric J-47 axial-compressor turbojet modified to take the afterburner, the reheat boost of which may be expected to raise the normal static thrust rating of 5,200 lb to around 7,000 lb at take-off and climb, and some 9,000 lb at top speed—assuming a fixed tailpipe nozzle. Since the standard F-86A is reported to have a sea-level maximum of at least 690 m.p.h. (M=0.91), the power potential of the YF-86D (in alliance with the Machian obliquity) looks good for raising the M to 0.95—that is, around 720 m.p.h. when functioning with the sting in the tailpipe.

Though its speed performance is outstanding, we do not believe that the prototype F-86D will normally be a supersonic performer at stratospheric altitudes. We may be a little sceptical in this regard—or a trifle wary when scaling the steep face of the drag mountain between M=0.90 and 1.0—but, according to our exploration of this still heady terrain, it will take a great deal more than a 70 per cent thrust boost to surge over the peak of the transonic divide at Mach unity. In any case, since the primary function of an interceptor fighter is to get upstairs in a hurry, the climb and ceiling boost of the F-86D (due to the afterburner) is of more significance than the increase in top speed. We shall return to that side of the performance picture in a moment.



Except for the nose and tail sections of the fuselage structure and the radio and radar installations, the rest of the YF-86D design is similar to that of its progenitor, and so the tooling changes are slight for the assembly line already laid down. For example, the wing and tail structures and the landing gear remain unchanged. The F-86 wing construction is a sandwich-type structure with double skins in combination with extruded hat-section stiffeners. This sounds conventional enough to-day, but the unorthodox feature of the construction lies in the introduction of "rolled-in" thickness-taper for the wing plating in the spanwise direction, in place of the more usual stepped gauges. North American, in fact, have created their own plate-taper machine-tooling for this purpose.

With the wing/tail relationship unchanged, the flight characteristics of the YF-86D should remain on a par with those of the F-86A—at any rate, up to a Mach Number of, say, 0.95. Wing and tail characteristics are influenced in the aerodynamic sense by the standard N.A.C.A. sweep angle of 35 degrees, which means to say that their critical Mach Numbers cannot be far apart, even allowing for the thinner tail section. With the afterburner boost turned on, the question arises as to whether the critical M of the tail is high enough to override the wing idiosyncrasies when shooting the transonic rapids, or approaching the entrance zone thereof. (Bearing in mind, however, the persistent rumours of Mach 3.0 in connection with the straight-wing-and-tailed Bell X-1A, maybe even the bright young aerodynamicists have lost their oars for the moment!)

The excellent lateral control characteristics of the F-86A wing should remain unimpaired when carried over to the YF-86D, since the latter employs the same design of aileron and leading-edge slat combination. Doubtless, one of the main reasons for this control efficacy can be traced to the large area ratio of the ailerons themselves, plus the anti-stall effectiveness of the leading-edge slats, which extend over about 85 per cent of the outer semi-spans. These automatic-type slats are provided with a manual override mechanism under the control of the pilot.

Despite the consuming thirst of the turbo-ramjet combination when the afterburner is turned on, the provision of the latter is a sound investment in boosting the rate of climb all the way from sea-level to altitude, and in greatly reducing the interception time to the operational ceiling. The accompanying graph illustrates our own private assessment of the afterburner effect on the climb performance of the YF-86D, from which it can be seen that the effect is exhilarating, to say the least. Thus, with the afterburner operative, the sea-level climb is boosted from 6,000 to 11,000 ft/min and the absolute ceiling from 44,000 to 54,000ft, while the time of climb to 40,000ft is reduced from 13.4 to 5.6 min. Again, the YF-86D, with afterburner in operation, can reach 50,000ft in 10.1 min., which is roughly the time taken to reach 36,000ft without the afterburner.

No claim is made that our performance slide-ruling is other than a qualitative comparison which purposely sidesteps a number of secondary effects and unknowns. For example, the compressibility drag rise with increase of forward climbing speed at altitude has been neglected, which means that the upper levels of the "afterburner on" case are probably a bit on the optimistic side. On the other hand, the potential thrust increase due to the afterburner

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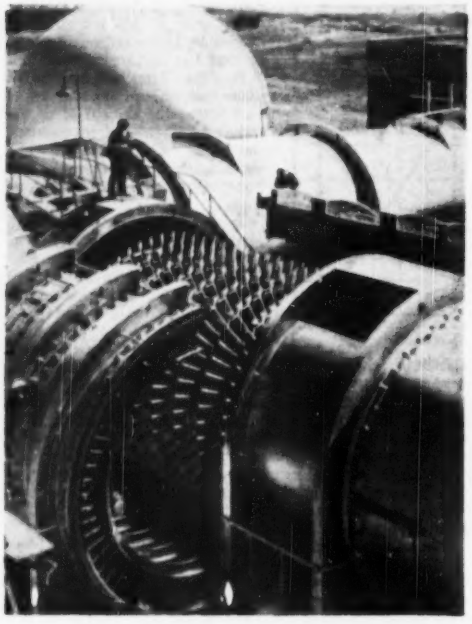
is almost certainly on the conservative side of the ledger, since the limitations of a fixed tailpipe-nozzle have been assumed in the present state of the art. Should the production F-86D incorporate a variable-area nozzle, as seems likely, then the thrust augmentation will be greater and the climb performance correspondingly better than in the case shown here.

The aerodynamic mixture which we have used in baking these two cakes consists of the following ingredients:—Gross weight (maximum permissible), 16,500 lb; overall wing span, 37ft 11in; length, 41ft; height, 14ft 9in; net wing area (excluding body cut-out), 256 sq ft; aspect ratio (based on net wing area and net span of 32ft 11in), 4.02; aerodynamic efficiency factor (includes span and sweepback reduction factors), 0.87; effective, or "virtual," aspect ratio (for induced drag), $4.02 \times 0.87 = 3.5$; minimum parasite drag coefficient (based on total wetted surface area of 1,370 sq ft and corresponding parasite drag area of 4.1 sq ft), 0.016.

These, then, are the aerodynamic constituents of the YF-86D airframe—in other words, the ingredients common to both cakes. The baking technique, however, is different in the two cases. A successful confection, of course, requires just the right amount of baking-powder and the correct flame temperature to make it rise to its optimum height. Thus, with only the turbojet turned on, the J-47 gas-stove produces a sea-level thrust at climbing speed of approximately 4,700 lb, but when the afterburner jets are also operating, the thrust is increased to roughly 7,000 lb. At 40,000ft the corresponding altitude thrusts have been computed as 1,600 and 2,500 lb respectively. (We are aware that the altitude thrusts may look a bit optimistic at first sight, but it should be borne in mind that the forward climbing speed is high—530 and 620 m.p.h. respectively.)

The addition of the ramjet burner to the gas-stove clearly produces a quicker-rising confection and, even though the gas consumption may look a bit extravagant during the actual rising process, the overall effect on the gas bill is not excessive, since the time to rise in the oven is much less. Certainly, from an interception viewpoint, it makes good military sense to burn some extra fuel in order to be on top of the opposing bomber at 50,000ft, instead of wallowing underneath it at 40,000ft; so the North American YF-86D looks like a promising probationer for stratospheric guard-mounting.



SUPER SUPERSONICS

Vast New 1,500 m.p.h. Wind Tunnel for U.S. Navy Research

THE newly released photograph, reproduced here, shows part of the huge supersonic wind tunnel built for the U.S. Navy at the Ames Aeronautical Laboratory, Moffett Field, California.

Power to drive the enormous axial-flow compressor is derived from two 25,000-h.p. motors coupled in tandem, the speed of rotation being given as from 775 to 900 r.p.m. to provide air speeds from 840 to 1,500 m.p.h. Understandably, the combination of a tunnel volume of 1,700,000 cu ft with air speeds such as those quoted results in a very considerable temperature rise. To dissipate this unwanted heat, a cooling membrane is interposed across the tunnel; it comprises over ten miles of bronze tubing in finned coils, the total surface area of which is 117,000 sq ft (or, perhaps more impressively, 2.69 acres), whilst the circulation-rate of cooling water is given as 10,200 gall./min.

By contrast with the jacketed form of the high-speed tunnel at the R.A.E. Farnborough, where no restriction is imposed on the airflow on the score of cooling, this use of a "radiator" membrane in the Ames tunnel would seem to impose some considerable penalty in back-pressure, and it may well be that much of the 50,000 h.p. provided by the driving motors is debited with this cooling incubus. We make these comments in no spirit of criticism. The American Navy is extremely lucky to have such a magnificent piece of research equipment as this new tunnel, and we can but wish, rather enviously, that something of the same kind existed in this country.

Scale is given by the human figures to indicate the gigantic dimensions of the axial-flow compressor.

BOOKS RECEIVED

Newnes' Engineers' Reference Book, 1949. George Newnes. Price 45s.

Aircraft Engines of the World, 1949, by Paul H. Wilkinson. Pitman. Price 50s.

Duckham's Road Book. Alexander Duckham and Co., Ltd., Bickley, Kent. Price 7s 6d.

So You Want to Enter Civil Aviation, by V. E. Mearles. *Daily Mail*. Price 7s 6d.

Newnes Engineer's Reference Book, 1949. Edited by F. J. Camm. George Newnes. Price 45s.

Guided Missiles, by A. R. Weyl. Temple Press. Price 7s 6d.

Modern Methods for the Analysis of Aluminium Alloys, by a Committee of Chemists convened by Alar. Chapman & Hall. Price 13s 6d.

Technology of Light Metals, by A. von Zeerleder. Elsevier Publishing Co., Inc. (Cleaver-Hume Press, Ltd.), 42a, South Audley St., W.1.

Brassey's Naval Annual, 1949. Edited by Rear-Admiral H. G. Thursfield. William Clowes and Sons, Ltd. Price 30s.

Week-ends Around Paris (hotel and restaurant guide of the Club des Sans Clubs). Seymour Press, Ltd., 22, Gt. St. James St., W.C.1. Price 2s 6d.

The Golden Reign, by Clare Sydney Smith. Cassell. Price 6s.

Hydra Small Tools (catalogue). Hall and Pickes, Ltd., Port Street, Manchester, 1.

Aeromodeller Annual—1949. The Model Aeronautical Press, Ltd., Allen House, Newarke Street, Leics. Price 7s 6d.

Neige et Soleil: Gastronomical Reports of the Club des Sans Clubs. Seymour Press, Ltd., Great St. James Street, London, W.C.1. Price 2s 6d.

Development of Aircraft Engines, by Robert Schlaifer, and *Aviation Fuels*, by S. D. Heron. Harvard Business School, Boston, Mass. Price $5.75.

POWER-ASSISTED CONTROLS

The Operation of Hydraulic Servo Systems

By C. A. H. POLLITT, M.I.E.D.

IT is a popular supposition that the essence of any power-assisted flying control system is that the pilot shall be furnished with a means of supplementing his limited physical capacity to an extent that will enable him to move with ease the control surfaces of large aircraft, the all-up weight of which may be of the order of 150,000 lb and more. Although this definition is substantially accurate it is, however, relevant to observe that the use of power-assisted flying controls is by no means confined to large multi-engined types; for a number of years servo units have been used with much smaller and faster aircraft, jet fighters predominant amongst them.

The need for power-assisted flying controls may be ascribed to four fundamental reasons. These are: (i) to afford effortless control of the considerable aerodynamic loads associated with large control surfaces; (ii) to overcome the substantial inertia loadings of linkage systems; (iii) to eliminate feed-back of the static loads of the control surfaces; and (iv) the damping-out of sudden gust loads more particularly associated with high-speed aircraft.

The essential characteristics of an efficient power-assisted flying control system may be summarized as follows:—

Fidelity.—The response characteristics of the usual manually-energized control system include an appreciable time-lag contributed by the aircraft's response to displacement of the control surfaces and also by the response of the mechanical linkage system itself. With power-assisted flying controls the fidelity of the system is defined as the relationship between the time function of the power input and that of the output under conditions of external disturbance. In some hydraulic power-controls the arrangement is such that the fluid flow is proportional to the positional error; by this means the pressure in the system becomes a function of the external forces plus the accelerations of the various masses of the flying control system.

Synthetic Feel.—Early investigations into the probable requirements of power-assisted control systems for aircraft embraced some consideration of the principles employed in marine steering equipment. This form of power-assisted remote control was found to be so fundamentally different from that required for aircraft that it was impossible to draw any significant conclusions. The fact that a ship's steering gear gives directional control in one plane only, whereas three-dimensional control is required for aircraft is, perhaps, the cardinal difference. Moreover, in the event of failure of a ship's steering gear the ship can heave-to while repairs are carried out, but there is no comparable procedure with aircraft, although adequate provision is always made for emergency control.

There was one feature of the investigations, however, which did justify common consideration. This was the question of "feel." It is a fact that so long as it is possible to feel the response of any mechanical steering gear to the manual energy applied to its movement, the more finely co-ordinated will be the movement of the mechanism. This is true on account of the sensitivity which, imparted by the feel of the mechanism, permits a knowledgeable anticipation of its behaviour under varying conditions of operation. Such anticipation, even though momentary, is indeed highly desirable with fast-moving aircraft. There is, in fact, evidence to show that when flying certain jet fighters with a maximum boost ratio of 10 : 1 (and which is adjustable in flight), the majority of pilots select a 6 : 1 ratio, thereby manifesting a general preference for not-too-near-minimum stick loads.

Irreversibility.—This is an essential pre-requisite. In one respect it is, perhaps, comparable with the principle of a shock-absorber in that the power control is required to dissipate any reverse loading such as may be imparted by aerodynamic loads on the control surfaces and, at all events, to prevent such loads being transmitted back to the control column. It is equally important that the system shall remain irreversible in the event of a failure in the power-supply circuit.

Unimpaired Response after Periods of Inactivity.—Periods of prolonged inactivity tend to divest a system of its spontaneous action, a fact which can hardly be dissociated from the characteristics of the power media employed. With hydraulic power, which is generally conceded to be the most suitable motivating force for servo controls, fluid-seepage and variations of temperature are two of the most common causes of trouble. Both these factors are, in large measure, influenced by the viscosity of the fluid in the system, and recent developments have clearly indicated the manifold advantages of the use of silicones as viscosity-stabilizing agents. Loss of pressure due to thermal contraction of the fluid can also be compensated by purely mechanical devices such as a spring-loaded piston accommodated within the piston-rod of the servo ram, which piston transmits fluid pressure via a suitably disposed orifice into the pressure chamber of the servo unit. Hobson powered flying-controls incorporate this feature.

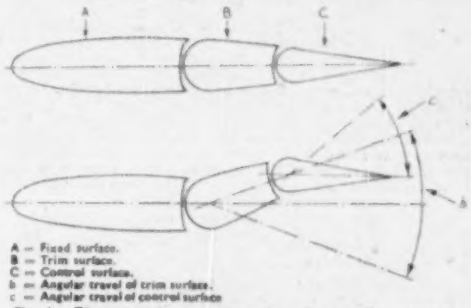


Fig. 1. Diagrammatic representation of manually operated control-assister with triple surface configuration.

Emergency Operation.—It is mandatory for a control-boost system to incorporate adequate facilities for emergency control. The obvious answer is to duplicate the system; but such a procedure is, for several reasons, prohibitive. In the first instance, airline operators have a rooted objection to hydraulics in general and to system duplication in particular. This aversion is largely attributable to maintenance difficulties—which, incidentally, constitute one of the operator's biggest headaches. With a military aircraft duplication of hydraulics promptly increases vulnerability; and with all aircraft there is a strict weight-penalty imposed by the additional pipes and equipment, not to mention the fluid within them.

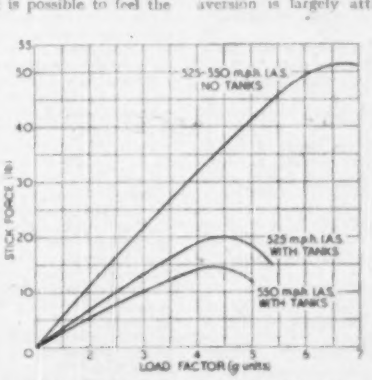


Fig. 2. Comparison of stick force with g for Republic Thunderjet at high speeds (I.A.S.) with and without wing-tip fuel tanks.

Temperature Range.—Satisfactory operation throughout temperatures ranging from −65 deg F to +150 deg F is also called for. This requirement is again largely contingent upon the fluid viscosity in the system, and earlier observations on "unimpaired response after periods of inactivity" are equally applicable here.

Autopilot Operation.—There are obvious advantages in a servo control system which can be operated by the automatic, as well as by the human, pilot. By placing the automatic pilot ahead of the boost linkage, the servo system can be made sensible to auto-pilot loads in precisely the same

way as it responds to action by the human pilot.

Basic Principles.—The use of power-assisted flying controls has followed as a logical development upon earlier experiments with manually-energized control-assisters. These assisters were in the form of trim tabs, balance tabs, flying tabs, and mass balances, by means of which it was contrived to supplement pilot effort. In their day, all these devices were reasonably satisfactory, though of limited application.

In Fig. 1 is shown a diagrammatic arrangement of a system in which the trimming surface is placed forward of the actual control surface but aft of the fixed surface and the hinge line. The principle of this configuration is that the actual (i.e., rearmost) control surface is available for normal flight control but not for extreme conditions of operation, such as take-off and landing. The main control-surface is actuated by the pilot's usual controls, and the trimming surface by an irreversible control. In practice, it has been found that the combined aerodynamic loads of the two surfaces, both of which have to be resisted by the pilot, assume so great a magnitude that the necessary reduction-gear precludes all possibility of fast operation should an emergency occur.

Stick Forces.—Stick-force characteristics are of salutary significance in any evaluation of power-assisted flying control systems. Conventional stick-force gradients have been extrapolated on the basis of lb/*g*, and are known to be critical with certain aircraft types. This embraces consideration of destabilizing influences created, in the case of long-range fighters, by such excrescences as external wing-tip fuel tanks. It is desirable that the stick-force gradient should lie somewhere between 3 lb and 9 lb per *g*, but it must be remembered that this function varies with altitude and with changes of c.g. location. Between sea level and 35,000ft the stick-force gradient per *g* unit varies by approximately 4.5 lb/*g*.

C. E. Pappas (chief of aerodynamics, Republic Aviation Corporation), addressing the New York section of the Institute of the Aeronautical Sciences, recently gave a stimulating exposition of these characteristics as applied to the F-84 Thunderjet. He made the point that whereas the specification for this aircraft permitted only a 6 lb/*g* variation between extreme flight conditions, the Thunderjet originally had, in fact, 11.5 lb variation.

By way of reducing the stick-loads induced by the relatively large ailerons, a maximum power-boost control-ratio of 10 : 1 was decided upon in conjunction with internal aerodynamic balancing. The amount of aileron deflection necessary for the very high rates of roll was not compatible with the aerodynamic balance which could be accommodated within the wing envelope, and it was this fact which necessitated a 10 : 1 power-boost ratio. It is understood that this combination of aerodynamic balance and power-assisted aileron control has proved eminently successful in practice.

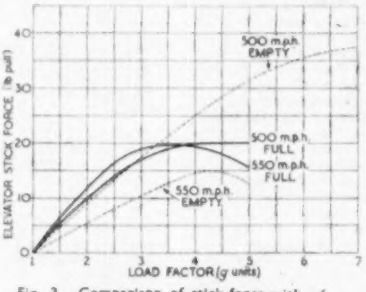


Fig. 3. Comparison of stick force with *g* for Republic Thunderjet at high speeds (h.A.S.) with full and empty wing-tip fuel tanks.

At high indicated air speeds, and with wing-tip fuel tanks fitted, it was subsequently discovered that the stick force per *g* curve had a pronounced peak between 4*g* and 5*g*, as shown in Fig. 2 for empty tanks and in Fig. 3 for full tanks. In general, these peaks occurred earlier with full tanks than with empty tanks.

Exhaustive tests were carried out with the object of eliminating these peaks, and the results proved that the moments and lifts were substantially constant with load factor, while the moment contribution of the tanks was sufficient to cause a 2.22 per cent forward movement of the Thunderjet's neutral point. Since measurements of stick-force gradients disclosed that the tanks caused a 2.5 per cent forward movement of the neutral point at Mach numbers below approximately 0.70, the tank moments were shown to account for the bulk of the change.

The System Proper.—The Vickers power-boost system installed in the Martin Mars provides an interesting example of an actual installation. Whereas a landplane can be manœuvred by wheel brakes, the absence of such a facility in a flying-boat demands effective directional control at slow speeds. Most of the earlier tab controls failed to achieve this purpose, because their functioning was generally contingent upon there being a certain minimum airload on the trimming surface. The application of power-assisted flying controls to large flying-boats is, therefore, of particular merit.

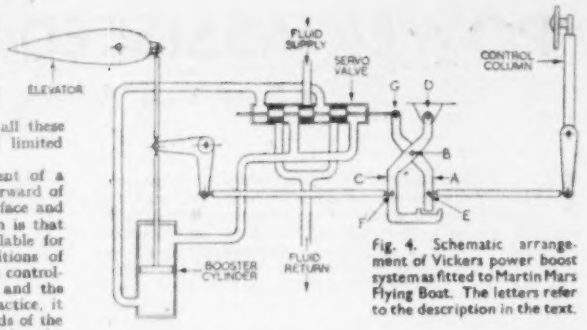


Fig. 4. Schematic arrangement of Vickers power boost system as fitted to Martin Mars Flying Boat. The letters refer to the description in the text.

A simple diagrammatic illustration of the system fitted to the Martin Mars is shown in Fig. 4. The servo valve and the boost cylinder are the vital elements, and the ratio of their piston diameters is directly proportional to the boost ratio.

Interposed between the servo valve and the control column is a scissors linkage designed to facilitate immediate straight-through manual operation of the system in the event of fluid-supply failure. This linkage also operates the servo valve in response to control-column movement. The operation cycle of the system is as follows: Assuming the elevator surface to be held in its neutral position by equal airloads from above and below, the pilot begins to move the control surface upward by moving the control column backward. The first slight motion of the control column rotates link A about point B. Since the elevator surface is held in a neutral position by airload, link C (which is pivoted on the aircraft structure) does not move. Rotation of link A pushes the servo-valve piston aft. Hydraulic fluid under pressure is admitted to the booster cylinder, causing the elevator to move up against airload as the control column continues to move aft. As the down airload on the surface increases, pressure builds up in the booster cylinder. It also builds up in the servo valve cylinder, thus providing a proportional load on link A and on the control column. As the elevator moves up, link C is rotated about point D, thus moving pivot point B. The control column moves aft at the same rate as the elevator moves up, so that the distance between points E and F remains constant.

In so far as Fig. 4 is a purely diagrammatic representation of this mechanism, it is necessary to explain that points D, G, E and F are actually on a common centre-line. When the pilot stops moving the control column, the elevator continues to move momentarily, because fluid is still being supplied through the open servo valve to the booster cylinder. The additional movement of the surface rotates link C about its pivot point D. Point E is held motionless by the control column, however, and point B therefore moves forward, pulling the servo-valve piston closed.

Under this stable condition, the down airload on the elevator surface is resisted by a pressure in the lower end of the booster cylinder, which is greater than that in the upper end of the cylinder. This same pressure is transmitted to the servo-valve piston which, through the linkage, acts on the control column, tending to move the column forward. The pilot must hold against this load. Should he release the control column, the servo-valve piston would then be allowed to move so as to relieve the excess pressure. This in turn would relieve the pressure exerted on the booster cylinder and allow the elevator surface to return to neutral. Should the control column be left free, it will in turn leave the servo-valve piston free to move in either direction. Obviously, the piston will not remain in any position unless the pressure in each end of the cylinder is the same. If this pressure is equal, the load on either side of the surface must also be equal.

In order to obtain proportional feel, the pressure line connecting the booster cylinder to the area between the centre and

POWER-ASSISTED CONTROLS . . .

left spools of the servo piston is also connected to the furthermost area of the servo cylinder. With this connection, and a similar connection of the opposite end of the booster cylinder to the opposite end of the servo cylinder, any differential pressure existing between the two ends of the booster cylinder also exists at the two ends of the servo cylinder.

A unique control lock is incorporated in the by-pass valve whereby it is possible, by inserting a key, to turn the valve and so trap oil on each side of the booster piston. The locking arrangement is such that the necessary key is not available for use in the lock valve until a locking-block has been installed in the cockpit control element.

Conclusions.—Although we have confined ourselves to a consideration of hydraulically operated servo controls, this should not be construed to imply the impracticability of any other power medium. Electrically energized systems have been developed, but have been found lacking in one or other of the previously defined essential characteristics. Electricity is the only alternative form of energy available, and an all-electric system may yet be evolved which will satisfy all requirements. Against this, however, it must be realized that the case for hydraulics is based entirely on one of its inherent physical properties, namely, its ability to absorb and transmit pressure. As a relatively incompressible fluid, hydraulic oil is particularly well-suited to the transmission of powerful rotary or linear movement over any distance.

It is particularly significant that the mere application of this fundamental property has been found to be the most satisfactory solution for power-assisted flying control systems and their associated problems. Hydraulic power is no panacea, however. For remote control over long distances electric operation is unequalled, and an electro-hydraulic system combining hydraulic actuation with remote electrical control may constitute the penultimate state of development. Failing electrical remote control, the purely hydraulic servo-control system tends not only to be heavy and complicated, but also introduces otherwise avoidable servicing difficulties. Quite apart from its remote-control propensities, electric energy has another very important attribute. We have seen that, in the case of the Vickers system in the Martin Mars (as well as with other installations), the use of an electrically driven hydraulic pump ensures complete reliability even in the event of main engine failure.

It is, perhaps, also relevant briefly to comment upon the manner in which hydraulic fluids have been rendered almost impervious to temperature-changes over the stipulated wide ranges now prevalent. The usefulness of an hydraulic fluid is determined largely by its viscosity-temperature behaviour. All fluids show some change in viscosity with changing temperatures, but no series of organic liquids is as nearly constant in viscosity over so wide a temperature range as are the silicone fluids. The methyl-silicone fluids are clear, colourless liquids. In contrast to the petroleum oils, they are only about 40 per cent organic. No doubt, their inorganic core of silicone and oxygen is responsible for their unusual properties, among which is low viscosity-change per unit change in temperature—the lowest, in fact, of any known liquid. This chemical structure is also responsible for their stable viscosity-temperature behaviour, shear resistance, and oxidation and heat-resistance. These properties, coupled with their extremely low freezing points, make them particularly useful in aircraft hydraulic systems.

ABOUT AVIATION IN N.Z.

THAT aviation is a very considerable force in the economic life of New Zealand—far more so than anybody not familiar with the Dominion would expect—is apparent from even a quick glance at *White's Air Directory and Who's Who in New Zealand Aviation*.* Published annually, this 170-page guide (which embraces every aspect of civil and Service aviation in the area) should be of value to firms in this country who do business in the area, or to executives contemplating a visit.

* *Published at 7s 6d by White's Aviation, Ltd., Dilworth Building, Auckland, New Zealand.*

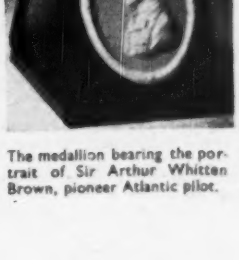
TRAINING FOR THE INDUSTRY

ALL education officers of firms in the aircraft industry, particularly in the London area, will be interested in a report, *Education for Aeronautical Engineering*, which reviews the present capacity for aeronautical technical training in and around the metropolis. It is published at 1s by the Regional Advisory Council for Higher Technological Education (London and Home Counties), 20, Fitzroy Square, London, W.1. The report, which concerns educational authorities only, is not intended for the use of prospective trainees.

COMMEMORATING ACHIEVEMENT

IN collaboration with Josiah Wedgwood and Sons, Short Brothers and Harland, Ltd., are annually having 500 medallions struck, carrying the portrait of an aviator whose achievements have advanced the cause of aeronautics, and these medallions will be sent to overseas clients of the firm.

They are about 5in high, and the portraits are modelled in bas - relief by Arnold Machin, A.R.A. The substance used—"Jasper" was discovered by Josiah Wedgwood in 1774, and since that time it has been used for portrait-medallions of distinguished people.



The medallion bearing the portrait of Sir Arthur Whitten Brown, pioneer Atlantic pilot.

Sir John Alcock and Sir Arthur Whitten Brown, who made the first trans-Atlantic flight, have already been featured in this series. Sir Keith Smith has been chosen as the subject for medalion No. 3. Recently, Rear-Admiral Slattery, managing director of Shorts, gave Sir Keith the opportunity of examining Arnold Machin's wax prototype.

A TEST PILOT'S RECORD

MR. W. H. SUTCLIFFE, export sales manager of Dunlop's aviation division, has just completed 10,000 flying hours. He first flew 33 years ago. During 11 years of Service flying his duties included those of instruction at Netheravon. He holds a Master Flying Instructor's Certificate, and for 12 years before the war he was chief instructor and secretary of the Midland Aero Club.

During the war he was a test pilot, first with Rolls-Royce, then with the Lockheed Aircraft Corporation, for whom he tested aircraft after their reassembly in England. He then became chief test pilot to Dunlop. Two years ago, as their export sales manager, he flew 21,073 miles on a tour of South America. He has also toured India, Ceylon, Egypt, Greece, Turkey, France, the Benelux countries, Scandinavia, Canada and America.

FORTHCOMING EVENTS

Feb	3.	R.A.F. Reserves Club: Annual Ball, Dorchester Hotel, London.
Feb	4.	British Interplanetary Society: Discussion—"Effects of Interplanetary Flight."
Feb	8.	R. Ae. S. (Brough): "Rocket Propulsion and Inter-Planetary Flight," by A. V. Cleaver, A.R.Ae.S.
Feb	9.	R.Ae.S.: "Producing a Prototype Aircraft," by C. F. Wilkins, A.F.R.Ae.S.
Feb	14.	R.Ae.S. Section Lecture: "Prototype Testing," by D. R. H. Dickinson, A.F.R.Ae.S.
Feb	17.	Institute of Navigation: "Air Traffic Control," a symposium of papers.
Feb	21.	R.Ae.S. (Belfast): "Strength-testing of Aircraft," by Dr. P. B. Walker, M.A., Ph.D., F.R.Ae.S.
Feb	21.	R.Ae.S. Section Lecture: "Air-intake Design for High-speed Aircraft," by Dr. I. Seddon, B.Sc.
Feb	22.	R.Ae.S. (Preston): "Radar and the Aircraft which Use it," by D. W. Hoolin, B.Sc.
Feb	23.	R.Ae.S. (Reading): "Propeller Turbines," by A. C. Clinton, F.R.Ae.S.
Feb	23.	R.Ae.S. Graduates: "Problems of Heat Transfer," by W. R. Shapey, B.Sc., Grad. R.Ae.S. and J. Rivers, Grad. R.Ae.S.
Feb	25.	Helicopter Association: "French Helicopter Development," by Col. R. H. Garry.
March	1.	R.Ae.S. (Weybridge): "Do Scientists Know Anything!" by C. G. Gray, F.M.R.Ae.S.
March	1.	R.Ae.S. Graduates: "Engineering Problems of Aircraft Design." (Joint meeting with I.E.E. and I.M.E. graduates.)
March	2.	R.Ae.S.: "Design for Maintenance," by R. G. Bishop, F.R.Ae.S.
March	4.	British Interplanetary Society: "Testing of Rocket Motors," by Dipl. Ing. H. F. Zoppe.
March	7.	R.Ae.S. Graduates: "Gas-turbine Installation," by J. C. Wallin, B.Sc., A.F.R.Ae.S.
March	8.	R.Ae.C.: Ball, Londonderry House.
March	14.	R.Ae.S. (Belfast): "Problems of High-speed Flight," by H. Davies, M.Sc., F.R.Ae.S.
March	15.	R.Ae.S. (Preston): Lectures by Branch Members.
March	16.	R.Ae.S.: "Air Survey," by G/C. F. C. V. Laws, C.B., C.B.E.
March	17.	Institute of Transport: Annual Dinner.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Esoteric?

RECENT correspondence regarding gas-turbine nomenclature by no means exhausts the list of terms liable to cause confusion. Standardization of technical terms is hedged with difficulties, as was well exemplified by the British Standards Institution publication, B.S.185, Pt. 2, dealing with aircraft power units, including turbines. This has recently been criticized, and defended, with considerable acerbity in the Journal of the Royal Aeronautical Society. There need be no objection to change or improvization provided it is a reasoned and not an arbitary process. Only general acceptance and usage can give validity to a rule or precept.

Why is a turbojet tailpipe nozzle frequently dubbed a "propelling" instead of "propulsion" nozzle? For what reason has the notation of specific fuel consumption been changed from lb/lb/hr to lb/hr/lb? It conflicts with the long-accepted lb/b.h.p./hr for the piston engine and I have noted an instance where a manufacturer used lb/hr/lb in the text but lb/lb/hr on the curves.

When referring to heat exchangers, the terms recuperator and regenerator are tossed about with a fine, careless abandon, though they have been differentiated since the days of the early hot-air engines. In a recuperator one medium transfers heat to a second medium through a thin dividing wall, whereas in a regenerator one medium delivers up heat to a body from which it is subsequently taken up by the second medium. Subject to correction, I believe the terms have been used in the opposite sense in the U.S.A., but I have seen recent evidence of conformity.

Reverting to the "afterburning or reheat?" query, it would be interesting to know who initiated the change. As the master, Sir Frank Whittle, still used "afterburning" in a fairly recent paper one must presume it to be a disciple. Can the disciples be afflicted, as disciples so commonly are, with an esoteric complex?

Nottingham. D. HEALEY.

Depression

HAVING read with some interest ("Service Aviation," *Flight*, January 19th) news of the reclassification of certain Wren air ratings, with the ultimate opportunity of their being selected for duty in the category of Pilot's Mate, may I, as a pilot, point out the adverse effect of the good lady (in the illustration accompanying the paragraph) sitting on the elevator? R. H. H. SLADE.

St. Agnes, Cornwall.

[Close examination of the original photograph suggests the more charitable interpretation that she was leaning across the Anson's elevator with her weight supported by one arm on the tailplane.—ED.]

Nos. 1 and 5 Groups Memorial

From Air Marshal Sir Aubrey Ellwood, K.C.B., D.S.C.

I AM sure that your readers will recall the dedication ceremony in Lincoln Cathedral on November 8th, 1949, when the Memorial Books of Nos. 1 and 5 Groups, Bomber Command, were handed over to the care of the Dean and Chapter of Lincoln. These Memorial Books contained the names of 21,000 members of aircrew who set out from their bases in Lincolnshire and the adjoining counties and failed to return. This most moving and memorable ceremony created intense interest, and I have received a volume of correspondence from relatives of those gallant men who gave their lives and whose names are commemorated in the Books.

It is evident that there is a general desire for some form of commemorative booklet, and I am glad to be able to announce that such a booklet is now being printed. The cover, in R.A.F. blue, is a facsimile of the appropriate Memorial Book, and the contents include the title page of the Memorial Book, a photograph of the R.A.F. Chapel, the Form of Service used at the dedication ceremony, and a complete list of names of those commemorated. An endeavour has been made to ensure that, in their small way, these booklets portray something of the magnificence of the Memorial Books themselves, and I am sure they will be prized by all those who obtain them.

In offering these booklets for sale to the public, a minimum price of 3s 6d per copy has been fixed to bring them within the reach of all. I would, however, ask all those who can afford to do so to contribute as generously as possible so that any surplus available, after production costs have been covered, may be given to the Cathedral authorities for maintaining and furnishing the R.A.F. Chapel—a cause which merits our wholehearted support.

Cheques and postal orders should be made payable to Headquarters, Bomber Command, and banknotes should be registered. Applications for booklets should be addressed to Headquarters, Bomber Command, Royal Air Force, High Wycombe, Bucks, and should show whether No. 1 Group or No. 5 Group booklet is required, and the number of copies. Relatives in doubt as to the Group should state the rank, name, initials and squadron of the personnel concerned. The booklets will be ready early in February.

A. B. ELLWOOD, Air Marshal,
A.O.C.-in-C., Bomber Command.

High Wycombe, Bucks.

[A moving commentary on the Cathedral ceremony was broadcast by the B.B.C. and a report, with photographs, appeared in *Flight* of November 17th.—ED.]

Synthetic Trainers

SINCE the publication in *Flight* of notes on B.O.A.C.'s synthetic trainer [October 27th, 1949], references have been made to synthetic trainers by two of your correspondents [November 17th, 1949, and January 19th, 1950]. The second of these correspondents has implied that expenditure in general and dollar expenditure in particular could have been kept at a lower level had some existing British synthetic trainer been adopted instead of the American type referred to in your notes.

To clear up any misunderstanding, I should like to point out that it is now more than ten years since, on behalf of my company, I put forward my plans to the Air Ministry and the Ministry of Aircraft Production for synthetic flight-trainers. Although there was considerable delay before my ideas were accepted, the first of the synthetic navigational flight-trainers was installed by my company and was in operation in a R.A.F. operational training unit during the summer of 1940. The R.A.F. Trainer Type 3 (or Rediffusion C.100) was fully described in Air Publication 1186B in May, 1942. The complete installation became known as the "gropes room" and was the forerunner of many synthetic flight trainers introduced by ourselves and others.

My company and B.O.A.C. have co-operated since last year in the provision of a flight simulator in this country with the object of avoiding the high dollar expenditure of other means of training and also to release the actual Stratocruiser aircraft for more dollar-earning hours. In this connection, we had to consider that, if the equipment had been entirely developed in this country, a delay of two to three years would have been incurred, with consequent increased direct dollar expenditure in training. All these factors were most carefully considered, not only by B.O.A.C. and ourselves, but also by the Government department concerned.

It should also be mentioned that the development effort which would have had to be put into this design, in the case of an entirely fresh trainer, would have been development effort at present mainly directed towards exportable articles. Further, it can be stated that my company, which pioneered synthetic flight crew-trainers, has not lost sight of the export market. On the contrary, we believe that before long we shall be able to add synthetic-trainer products to our already considerable range of exports.

As to the general comment by one of your correspondents on the high cost of the equipment, while I greatly appreciate the work done on many of the synthetic trainers during the war, I do not think that any of those trainers were as complete as the flight simulator which is now being built for B.O.A.C.

The fact remains that, based on practical experience of a similar trainer in America, it has been shown that the complete cost of the equipment will be paid for in less than three years out of savings made on training of flight crews.

P. ADORIAN, Vice-Chairman,
London, S.W.1. Redifon, Ltd.

In Brief

Mr. P. F. Wright, Cavendish House, 39-41, Waterloo Street, Birmingham, 2, hon. secretary of the Birmingham and District Aviation Club, writes to suggest that this organization will meet the needs of correspondents who have recently enquired about discussion and correspondence clubs.

SERVICE AVIATION

Royal Air Force and Naval Aviation News and Announcements

Boscombe Command

AIR COMMODORE A. W. B. McDONALD, C.B., A.F.C., has succeeded Air Commodore H. L. Patch as officer commanding the Aeroplane and Armament Experimental Establishment, Boscombe Down, under the Ministry of Supply. He spent last year as a student at the Imperial Defence College and was formerly Commandant of the R.A.F. Staff College, Andover, from October, 1946.

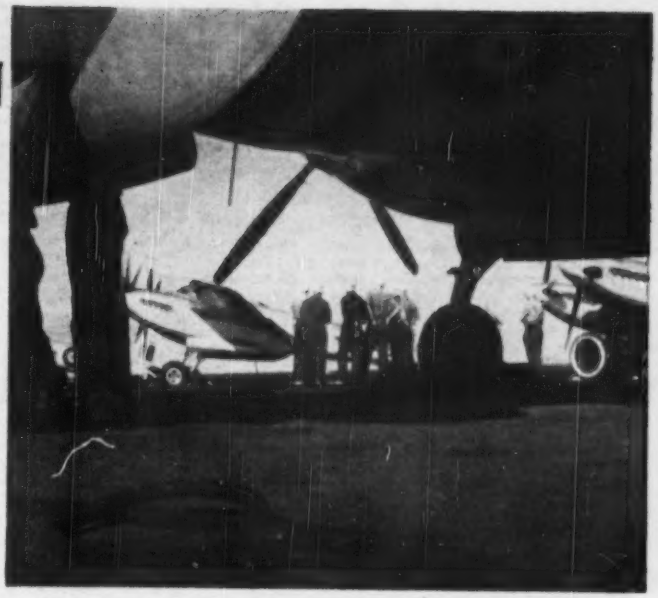
Malayan Air Strikes

SINCE the beginning of the Malayan Emergency some 350 strikes against bandits have been made. Previously, reports on the results have been very scanty, and under the conditions of the dense jungle and the time lag between air strikes and the arrival of ground forces in the target area, this was to be expected; but surrendered bandits have given a good guide.

The material damage caused by air strikes, according to an R.A.F. spokesman in Kuala Lumpur, is negligible. The type of hut camp used by the bandits is easily constructed and repaired; nevertheless the average bandit is well below the normal standard of intelligence, and what intelligence he has is dulled by the continuous and monotonous life in the jungle. While he has some knowledge of firearms—even automatic weapons—and is prepared to attack a soft target where the chances of opposition are slight, he becomes afraid and jittery when attacked from the air by bombs, rocket projectiles and cannon-fire, against which he is helpless to do anything but hide or shelter as best he can until the strike is over. Complete surprise has been achieved in many cases. Abandoned camps, with documents, clothing, arms and meals in course of preparation which have been found by follow-up forces bear witness.

The moral effect of air strikes on the bandits is most marked. They have no means of hitting back. The noise of bombs and rockets resounds through the trees, camps are hastily evacuated and gangs are broken up. They join up again at the appointed rendezvous only if they can find it. Sometimes the weaker malcontents hide their arms and make their way in to surrender. An air strike not only affects the bandits, but it also impresses the squatters and local inhabitants living in the area.

Bandit reports of high grade have mentioned in all 102 killed and 22 wounded. In addition, unconfirmed reports of lower grading speak of a further 51 killed and 38 wounded. Considering that, in camps, the mention of casualties is punishable by death, it is very probable that enemy killed and wounded as a direct result of air strikes may number many more.



FLIGHT DECK : The D.H. Sea Hornets are ready and waiting and the handling party stands by for starting up the Rolls-Royce Merlins—a cameo from H.M.S. *Implacable*.

Auxiliary Appointment

THE Air Ministry announces the appointment of the Rt. Hon. the Earl of Shrewsbury and Waterford, J.P., D.L., as Honorary Air Commodore of No. 3509 (County of Stafford) Fighter Control Unit, R.Aux.A.F. No. 3509 F.C.U., which has its headquarters at Trentham, Stoke-on-Trent, is commanded by W/C. J. M. M. Bloor. The new Honorary Air Commodore served in the war as a Royal Artillery officer in the Middle East and Italy.

Exercise *Sweetbriar*

AIR FORCE units participating in Exercise *Sweetbriar*, the joint Canadian-United States winter training operation to be held in the Yukon and Alaska this month, are to be under the command of G/C. P. A. Gilchrist, D.F.C., of the R.C.A.F. Overall command of the exercise will be vested in Lt.-Gen. S. J. Chamberlin, Commanding General of the United States Fifth Army. Commander of the Offensive Support Wing under G/C. Gilchrist will be W/C. D. G. Mallory, D.F.C., and the Transport Wing will be under W/C. W. F. Parks, D.F.C. Participating R.C.A.F. squadrons and units will include Nos. 410 and 417 Fighter Squadrons, 426 and 435 Transport Squadrons, 112 Transport Flight, 408 Photo Squadron, and a Composite Light Bomber Flight.

Group Captain P. A. Gilchrist, D.F.C., R.C.A.F.

The New D.O.R.

AIR COMMODORE H. V. SATTERLY, C.B., C.B.E., D.F.C., has been appointed Director of Operational Requirements at the Air Ministry. Until recently he was Assistant Commandant of the R.A.F. Staff College, Bracknell, Berks, and before going there in September, 1948, he was Senior Air Staff Officer, British Joint Services Mission, Washington, for two years.

During the war Air Commodore Satterly was at the Air Ministry, in the Directorate of Staff Duties, until early in 1941. He then served for five months with No. 83 Squadron and was awarded the D.F.C., and later in 1941 commanded R.A.F. Station, Swinderby, Lincs. In 1942 he went to No. 5 Group, Bomber Command, as Senior Air Staff Officer, remaining there until August, 1944, when he was appointed to command a bomber base in No. 4 Group. Two months later he returned to No. 5 Group to command a Pathfinder base. Towards the end of the war he was given the acting rank of air vice-marshal and appointed S.A.S.O. of "Tiger Force," the bomber force which would have gone into operation against Japan but for the surrender. He was afterwards Air Officer in Charge of Administration at Air Headquarters, Burma, until August, 1946, when he went to the U.S.A.

A.T.C. Boxing Championships

ONE can be certain of seeing amateur boxing at its best at least once a year by attending the annual A.T.C. National Boxing Championship Finals at the Albert Hall. On Monday evening, January 23rd, a large crowd of spectators watched a programme comprising nine junior and eight senior bouts, each of

SERVICE AVIATION . . .

three rounds, 10 qualify for which the cadets had fought through unit, wing, group and inter-group contests, and Northern and Southern Area Finals.

Events started with a close bout at midget weight (7 stone) for the cup presented by *Flight*. Cdt. R. Higgins, the Southern champion, narrowly defeated Cdt. Monahan, Northern champion, on points. The outstanding bout of the evening was between the two Davises, B. Davis of 261 (Guildford) Sqn., and W. E. Davis of 1000 (Bedlington) Sqn. They both fought with tremendous determination, and both went down during the first two rounds but came back with remarkable aggression. The fight was stopped at the last minute in favour of the Southern champion, B. Davis, although his opponent, by sheer guts, was for the third time staggering to his feet. Tremendous applause indicated everyone's approval of the award of the Roy Limbert Cup to W. E. Davis for the best loser of the championships.

Two other outstanding bouts were the Junior featherweight, between Cdt. P. Harrington, 261 (Guildford) Sqn. and a coloured cadet, Cdt. Bangbala, 287 (Belle Vue) Sqn. (the latter, a gallant loser on points, was exceptionally fast and had a beautiful physique) and the senior flyweight between Cdts. D. Flack and F. Wills. Cdt. Flack, 1948 *Flight* cup winner, looks a most promising young fighter and, aways on the offensive, did well to gain a near but clear decision.

The A. J. Elvin cup for the best performance in the Championships was clearly earned by (junior, lightweight) Cdt. R. Blackburn, 1701 (Johnstone) Sqn., Scotland, although others whose names must have received careful consideration were Cdts. P. Smith, E. O'Brien and J. Shannon.

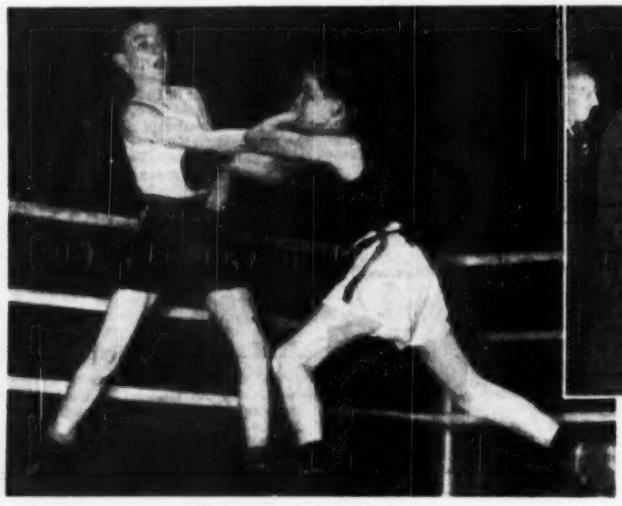
The lesson to be learned from the evening, especially from the junior bouts, was that the man who had learned to keep plugging and building up points with a straight left was at least half-way towards victory.

A. F. Tinsley, writing in the souvenir programme on the subject of boxing in the R.A.F. says that whether the cadets who win or lose continue to box when they pass into the parent Service is not particularly important. What does matter to the R.A.F. is that a spirit and character moulded in the ring and gymnasium early in their lives will remain with them throughout their Service careers. He also quotes Col. R. B. Campbell, an authority on boxing, who wrote: "The applause soon dies away; the prize is left behind; but the character you build up is yours for ever." That is how the R.A.F. regards boxing.

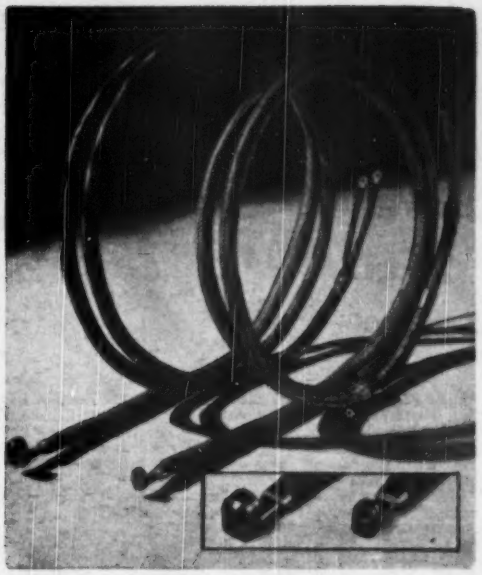
The Harewood Trophy for the A.T.C. Group gaining the greatest number of points in the final was won by 61 Eastern Reserve Group—The Star Silver Wings Trophy, awarded to the A.T.C. Squadron in the South with the greatest number of winners in the finals, has been won by No. 1061 (Southwark) Squadron, and it is expected that the A.O.C. of 65 Group, A. Cdre. Ackerman, will shortly present the trophy to them. The Northern Wings Trophy awarded for the same achievement in the North has already been presented (at Carlisle) to No. 498 (Wishaw) Squadron, Scotland.

Bout	Name of Winner*	Squadron	Name of Opponent	Squadron	Trophy	Presented by
7st midget ...	Cdt. R. Higgins (S)	1182 (Mendip)	Cdt. Monahan	281 (Southport)	*Flight* Cup	The Editor of *Flight*
7st 7lb mosquito ...	Cdt. B. Hirst (N)	59 (Huddersfield)	Cdt. H. Cotterell	1568 (Spoadwell)	Sir Bertram Jones Cup	A. Cdre. Sir Guy Garrod
8st 6lb ...	Cdt. W. E. Powell (S)	1223 (Caerphilly)	Cdt. Perkins	347 (Dudley)	*The Aeroplane* Trophy	Editor of *The Aeroplane*
8st 7lb bantamwt. ...	Cdt. D. J. Thomas (S)	1812 (Dowlais)	Cdt. G. (Brough)	103 (Doncaster)	Simon Marks Trophy	Lord Balfour of Inchyre
9st featherwt.	Cdt. P. Harrington (S)	261 (Guildford)	Cdt. Bangbala	287 (Belle Vue)	Aeronautics Cup	Air Marshal Sir Alan Lees
9st 7lb lightwt. ...	Cdt. R. Blackburn (N)	1701 (Johnstone)	Cdt. J. N. Bandeo	2158 (Borough Green)	Eland Cup	F/L Miles
10st welterwt.	Cdt. S. Ray (S)	1061 (Nelson School)	Cdt. Maynard	247 (Ashton-under Lyne)	Chamier Cup	Air Marshal Sir Aubrey Ellwood
10st 7lb middlewt.	Cdt. E. O'Brien (S)	1061 (Nelson School)	Cdt. D. Fearnley	127 (Wakefield)	Bailey Cup	Air Marshal Sir Basil Embry
11st heavywt....	Cdt. D. Hother (S)	1061 (Nelson School)	Cdt. Lyons	1262 (Blackburn)	Lord Londonderry Cup	Air Marshal P. C. Livingstone
			SENIORS			
8st. flywt. ...	Cdt. D. Flack (S)	261 (Guildford)	Cdt. F. Willis	817 (Lisburn)	Lawley Cup	Air Marshal Sir Leslie Hollinghurst
8st 6lb bantamwt.	Cdt. B. Mussell (S)	2182 (Dorchester)	Cdt. D. Webb	498 (Wishaw)	Lord Glendyne Trophy	Air Marshal Sir John Steel
9st featherwt.	Cdt. P. Smith (N)	59 (Huddersfield)	Cdt. C. Bishop	2122 (Vauxhall)	Duncan Smith Trophy	Air Marshal Sir John Whitworth Jones
9st 9lb lightwt.	Cdt. B. Davis (S)	261 (Guildford)	Cdt. W. E. Davis	1000 (Bedlington)	Air Reserve *Gazette* Trophy	Air Marshal Sir Hugh Saunders
10st 7lb welterwt.	Cdt. K. Woodward (S)	2172 (Vauxhall)	Cdt. F. Marshall	1053 (Armthorpe)	Hilary Cup	Air Marshal Sir Arthur Sanders
11st 6lb middlewt.	Cdt. J. Shannon (S)	1061 (Nelson School)	Cdt. J. McClafferty	498 (Wishaw)	Arthur Mach Cup	A. V.-M. R. M. Foster
12st 7lb lt. hvy. wt....	Cdt. R. Ayling (S)	1582 (Ardale School)	Cdt. Cpl. M. Sloan	498 (Wishaw)	Sir Harry Price Cup	Air Marshal Sir Hugh Walmsley
Heavywt. ...	Cdt. A. E. Prail (N)	1000 (Bedlington)	Cdt. R. R. Daniels	1582 (Ardale School)	Robert Straus Trophy	Marshal of the R.A.F. Lord Tedder

* Bouts were between Southern and Northern champions. (S) or (N) indicates the winner's area.



(*Above*) Air Chief Marshal Sir John Slessor presents the Elvin Cup to Cdt. R. Blackburn for the best performance in the championships. (*Left*) Cdt. R. Higgins, 1182 (Mendip) Squadron, 62 Group, winner of the *Flight* Cup, on the offensive against Cdt. Monahan of 63 Group.



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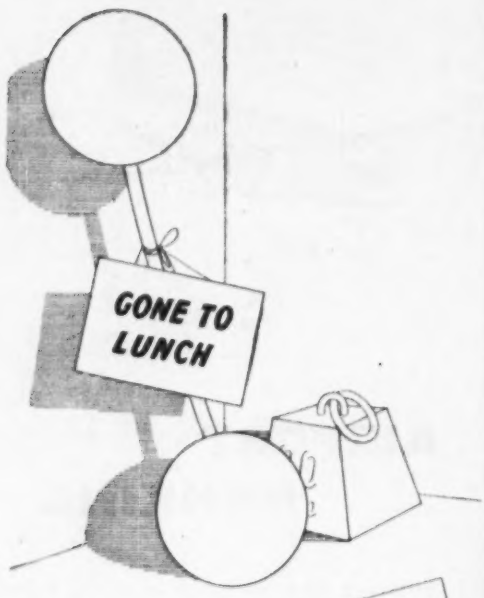

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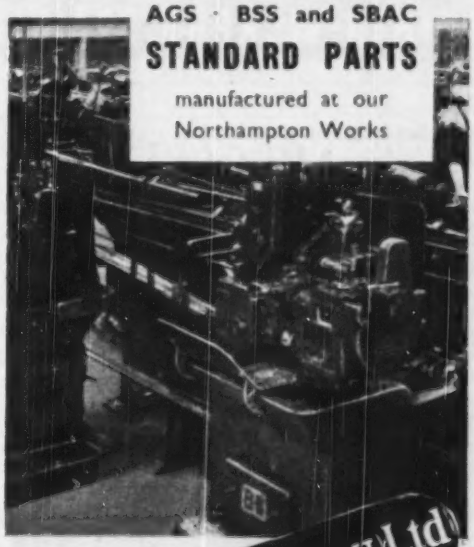

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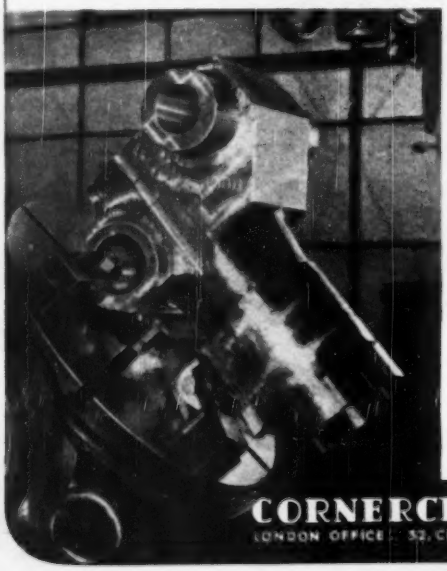

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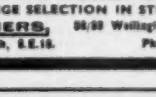

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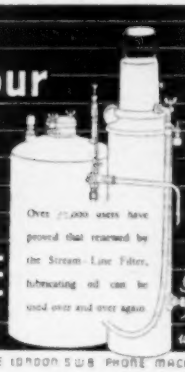

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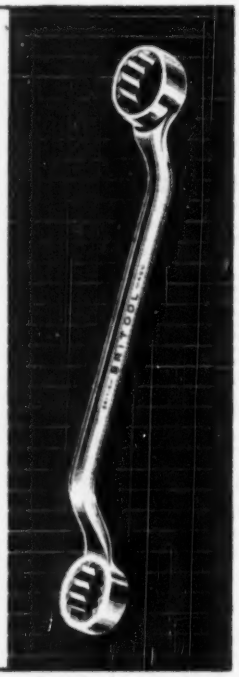

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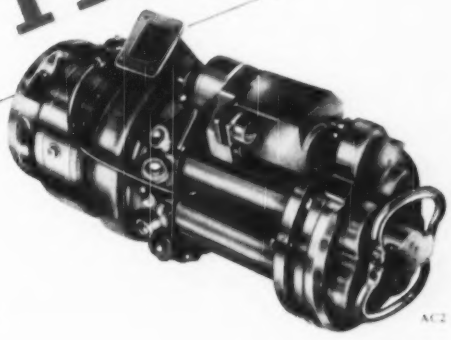

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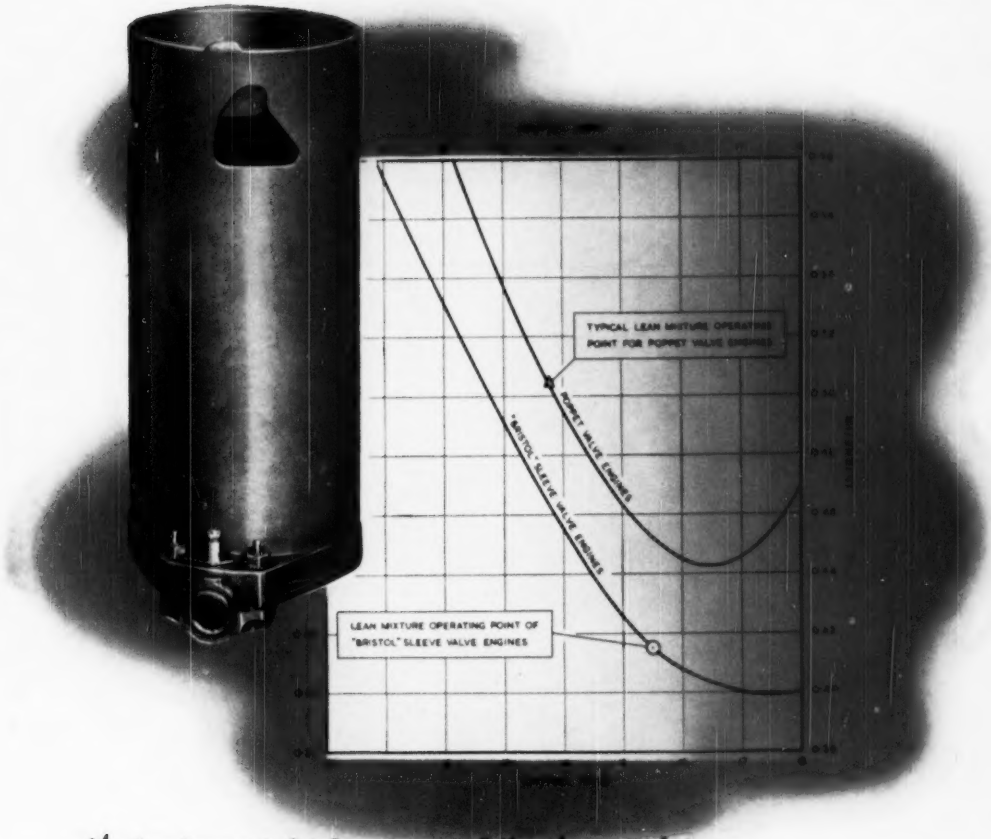
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